



## 2005 NDIA Combat Vehicles Conference

**Shepherdsville, KY**

**20-22 September 2005**

Revised Agenda

**Wednesday, 21 September 2005**

### **SESSION I - Requirements and Warfighting**

**Keynote Address:** Balanced Modernization, by LTG Mark Curran, USA, Deputy Commanding General, Futures and Director, Futures Center, US Army Training and Doctrine Command

**War Panel:** Operation Iraqi Freedom

**Moderator:**

- MG J. B. Burns, USA (Ret)

**Panelists:**

- Key Points, by COL James B. Hickey, USA, Director, JAWP APO
- Fighting the Guerilla in Iraq: Tactical Insights from the 4th Infantry Division, by LTC Steven D. Russell, USA, Chief of Tactics, USAIS
- Assault Amphibian Vehicles (AAVs) in 1st Marine Division for Operation Iraqi Freedom, by Col Robert S. Abbott, USMC, Chief National Plans Branch (PLN), Plans Polices and Operations, HQMC
- Operation Al Fajr - The Battle for Fallujah, by Col Mike Shupp, USMC, Commanding Officer of the 1st Marine Regiment 1st Marine Division (Rein), FMF Camp Pendleton

Ogden Ops-Sequence (*Video*)

### **SESSION II: U.S. Marine Corps Session**

USMC Agenda

Maintaining the Corps Today While Preparing for Tomorrow, by Col Michael J. Mulligan, USMC, Director, Infantry Weapons Systems, Marine Corps Systems Command

**Today's Combat Vehicles:**

- PM AAVS Program Brief
- USMC LAV Modernization Plan, by Col John J. Bryant, USMC, Program Manager, Light Armored Vehicles, USA TACOM

Expeditionary Fighting Vehicle (EFV), by Col Mike Brogan, USMC, DRPM Expeditionary Fighting Vehicle, Worth Avenue Technology Center

EFV OPM (*Video*)

**Thursday, 22 September 2005**

### **SESSION III: Future to Current**

Combat Systems - Where We Are... Where We're Going... and Like a Rock (*Video*), COL Larry D. Hollingsworth, USA, Project Manager, Combat Systems (Tank: Abrams/Bradley)

Stryker 'Move' (*Video*)

Shoot MGS (*Video*)

Communicate (*Video*)

Army Racing (*Video*)

**Panel:** Future Combat System/Unit of Action Panel Update

Update (*Presentation*)

Tiger Short (*Video*)

Surv2 (*Video*)

Surv3 (*Video*)

**Moderator:**

- COL Charles Coutreau, USA, Program Manager Manned Ground Vehicle (MGV)

Panelists:

- Mr. Tom Hartigan, Program Manager, US - Reliability
- Mr. Dan Holtz and Mr. Dick Williams, Boeing
- Mr. Dean Vanderstelt, General Dynamics Land Systems (GDLS)
- Mr. Mike Zoltoski, TARDEC
- Mr. Peter DeMasi, Program Manager, US/Lethality Systems

Thank You! (*Video*)

# Revised Agenda

## Tuesday, September 20, 2005

- 1:00 p.m. - 6:00 p.m.      Golf Tournament  
(Shotgun start/tee times)  
*Lindsey Golf Course, Ft. Knox*
- 5:00 p.m. - 7:00 p.m.      *Welcome Reception and Registration / Security Check-in*  
Country Inn & Suites, Shepherdsville

## Wednesday, September 21, 2005

- 7:00 a.m. - 7:30 a.m.      Shuttle Busses depart from individual hotel parking lots for  
*Gaffey Hall, Fort Knox*  
To assist in our planning purposes, please indicate on the registration form or  
online if you plan on using this service.
- 7:30 a.m. - 4:30 p.m.      Registration & Security Check-in
- 7:30 a.m. - 8:15 a.m.      Continental Breakfast

**Session I - Requirements and Warfighting**  
Session Chair - *LTG John S. Caldwell USA (Ret.)*  
*QSS Group*  
and  
*Chairman, Combat Vehicles Division, NDIA*

- 8:15 a.m. - 8:25 a.m.      Administrative Announcements
- 8:25 a.m. - 8:45 a.m.      *Welcome to Fort Knox - Transformation Update*  
*MG Terry L. Tucker, USA*  
*Commanding General (CG)*  
*U.S. Army Armor Center and Fort Knox*
- 8:45 a.m. - 9:30 a.m.      ***Keynote Address***  
*Lieutenant General John M. Curran, USA*  
*Director, Futures Center*  
*United States Army Training and Doctrine Command*
- 9:30 a.m. - 9:50 a.m.      Coffee Break
- 9:50 a.m. - 12:15 p.m.      ***War Panel: "Operation Iraqi Freedom"***  
Moderator: *MG J. B. Burns, USA (Ret.)*  
Panel Members:  
*LTC Jim Mingo, USA*  
*Commander, 3rd Battalion, 8th Cavalry*  
*COL James B. Hickey, USA*  
*Director, JAWP APO*  
*LTC Steven D. Russell, USA*  
*Chief of Tactics, USAIS*  
*Col Robert S. Abbott, USMC*  
*Chief, National Plans Branch (PLN)*  
*Plans, Policies and Operations, HQMC*  
*Col Mike Shupp, USMC*  
*Commanding Officer of the 1<sup>st</sup> Marine Regiment*  
*1<sup>st</sup> Marine Division (Rein), FMF Camp Pendleton*

# Revised Agenda (continued)

Wednesday, September 21, 2005 (continued)

- 12:15 p.m. - 12:30 p.m.      Busses shuttle attendees to the *Leader's Club* for lunch
- 12:30 p.m. - 1:30 p.m.      Lunch with Speaker  
*Mr. Richard B. Ladd*  
*President, Robinson, International*
- 1:30 p.m. - 1:45 p.m.      Busses shuttle attendees back to *Gaffey Hall* for *Session II*
- Session II: U.S. Marine Corps Session**
- Session Chair - *Col Reed Bolick, USMC (Ret.)*  
*Cypress International*
- 1:45 p.m. - 1:55 p.m.      **Introductions**  
*Col Reed Bolick, USMC (Ret.)*
- 1:55 p.m. - 2:35 p.m.      **Maintaining the Corps Today While Preparing for Tomorrow**  
*Col Michael Mulligan, USMC*  
*Director, Infantry Weapons Systems*  
*Marine Corps Systems Command*
- 2:35 p.m. - 3:35 p.m.      **Today's Combat Vehicles**  
  - *Mr. Bryan Prosser*  
*AAV Program Manager, MARCORSYSCOM (PMM-143)*
  - *Col John Bryant, USMC*  
*Program Manager, Light Armored Vehicles, USA TACOM*
  - *LtCol John D. Swift, USMC*  
*Tank Program Manager, MARCORSYSCOM (PMM-142)*
- 3:35 p.m. - 4:05 p.m.      Coffee Break
- 4:05 p.m. - 4:45 p.m.      **Tomorrow's Expeditionary Fighting Vehicles (EFV)**  
*Col Michael M. Brogan, USMC*  
*DRPM Expeditionary Fighting Vehicle*  
*Worth Avenue Technology Center*
- 4:45 p.m. - 5:00 p.m.      **Marine Corps Q&A**
- 5:00 p.m.      Adjourn for the day
- 5:15 p.m. - 5:30 p.m.      Busses shuttle attendees to *The Patton Museum* for the  
*Annual Reception*
- 5:30 p.m. - 7:00 p.m.      **Annual Reception at The Patton Museum**
- 7:15 p.m. - 7:45 p.m.      Shuttle Busses depart *The Patton Museum* for individual hotel  
parking lots

# Revised Agenda (continued)

Thursday, September 22, 2005

7:00 a.m. - 7:30 a.m.	Shuttle Busses depart from individual hotel parking lots for <i>Gaffey Hall, Fort Knox</i>
7:30 a.m. - 11:45 a.m.	Registration & Security Check-in Continues
7:30 a.m. - 8:00 a.m.	Continental Breakfast
	<p style="text-align: center;"><b><u>Session III: Future to Current</u></b></p> <p style="text-align: center;">Session Chair - <i>Dave Longley</i> <i>BAE Systems</i></p>
8:00 a.m. - 8:30 a.m.	<i>COL Larry D. Hollingsworth, USA</i> Project Manager, Combat Systems (Tank: Abrams/Bradley)
8:30 a.m. - 9:00 a.m.	<i>PM Stryker</i> <i>COL Peter Fuller, USA</i> Program Manager, Stryker
9:00 a.m. - 9:30 a.m.	<i>Armored Security Vehicle (ASV)</i> <i>LTC Steven Herold, USA</i> Chief Military Police <i>Fort Leonard Wood</i> <i>MAJ Stanley Scott, USA</i> Program Manager, Armored Security Vehicle (ASV)
9:30 a.m. - 10:00 a.m.	<i>Coffee Break</i>
10:00 a.m. - 12:00 noon	<i>Future Combat System/Unit of Action Panel Update:</i> Moderator: <i>COL Charles Couteau, USA</i> , Program Manager, Manned Ground Vehicle (MGV) Panel Members: <i>COL Charles Couteau, USA</i> , Program Manager, Manned Ground Vehicle (MGV) FCS & Manned Ground Vehicle (MGV) Overview <i>Mr. Tom Hartigan</i> , Program Manager, UA - Reliability Reliability, Availability and Maintainability / Reliability Improvement Program (RAM/RIP) <i>Mr. Dan Holtz and</i> <i>Mr. Dick Williams</i> , <i>Boeing</i> MGV Best Technical Approach <i>Mr. Dean Vanderstelt</i> , <i>General Dynamics Land Systems (GDLS)</i> Power & Energy <i>Mr. Mike Zoltoski</i> , <i>TARDEC</i> Survivability Technology Efforts <i>Mr. Peter DeMasi</i> , <i>Program Manager, UA/Lethality Systems</i> Lethality

# Revised Agenda (continued)

Thursday, September 22, 2005 (continued)

12:00 noon - 12:15 p.m.

*Closing Remarks*

*LTG John S. Caldwell, USA (Ret.)*

*Chairman, Combat Vehicles Division, NDIA*

12:15 p.m.

*Conference Adjourns*

12:15 p.m. -12:45 p.m.

Shuttle Busses depart *Gaffey Hall* for individual hotel parking lots

*The Combat Vehicles Section of the  
Tank, Automotive, and Armaments Division of NDIA thanks you for attending  
& we look forward to seeing you again next year.*

*The National Defense Industrial Association (NDIA) thanks you  
for your participation in this year's conference,  
and wishes you a safe trip home.*

Please visit our website:

<http://www.ndia.org>

## 2005 NDIA Combat Vehicles Conference

### *Attendee Information:*

#### *Message Center*

For your convenience, a message board will be located at the the *2005 NDIA Combat Vehicles Conference* (in the Rivers Auditorium at Gaffey). Attendees should have faxes sent to their individual hotels, "Attn: your room#".

#### **NDIA Registration Desk - ph#'s to be provided on-site**

Country Inn & Suites by Carlson - Shepherdsville  
400 Paroquet Springs Drive  
Shepherdsville, KY 40165  
Telephone: (502) 543-8400  
FAX: (502) 543-8469

Hampton Inn Louisville I-65 @ Brooks Rd.  
I-65, Exit 121 (Brook Hill Road)  
180 Willabrook Drive  
Shepherdsville, KY 40109-5254  
Telephone: (502) 957-5050  
FAX: (502) 957-3315

Fairfield Inn - Louisville South  
I-65, exit 121  
362 Brenton Way  
Shepherdsville, KY 40165  
Telephone: (502) 955-5533  
FAX: (502) 955-5547

Baymont Inn  
191 Brenton Way  
Shepherdsville, KY 40165  
Telephone: (502) 955-9550  
FAX: (502) 955-9867

#### *Proceedings & Point of Contact Information ("List of Attendees" Corrections)*

The proceedings for this meeting will be posted through a link on the NDIA web site after the conference. The link will be emailed to the conference attendees 2-3 weeks after the conference. To ensure you receive email link, please make sure the your email address that is published in the attendee list included in this revised agenda hand-out is correct.

If any part of your contact information is incorrect on the "List of Attendees" included in this "Revised Agenda" hand-out, please stop by the Conference Registration desk to make note of the corrections on the "Master Copy", so we can update our database. We appreciate you're letting us know of any errors.

# Attendee Information (continued)

## *Surveys*

We appreciate any comments or suggestions you may have regarding this event. Please return the *2005 NDIA Combat Vehicles Conference Meeting Survey* to the conference registration desk located in Gaffey Hall. If you don't have the time to fill-out the survey now, you can fax it to 703-522-1885 at your convenience.

## *Miscellaneous:*

### *Gaffey Hall, Leader's Club & Patton Museum*

Please note: there is no-smoking in Gaffey Hall, the Leader's Club, or the Patton Museum facilities.

## **Security –**

**\*\*Before and while you are on base: You must carry all forms of ID, e.g. Driver's License, passport, foreign visitors, Visit Request Form, Corporate contact letter, etc., at all times during the conference.\*\***

**\*\* Please note: if you are a Foreign National/Resident Alien, and will be riding the shuttle bus, AND HAVE NOT submitted all the necessary paperwork, you will be removed from the bus, and may encounter a lengthy clearance process that averages 3 hours. \*\***

Upon entering Gaffey Hall, any items you are carrying - e.g. briefcases, etc., are subject to searched again.

For security reasons & to help save time, we respectfully ask that you check any personal items (luggage, computer bags, coats, etc.) with the front desk at your hotel. You will need to present your room key and/or photo I.D. The NDIA staff will not accept any of the above.

## **Cell Phones/Beeper Usage –**

We respectfully ask that you turn-off your cell phones, beepers, etc. (or, turn them to "vibrate"), out of courtesy to the conference speakers and your fellow attendees.

## **Revised Agenda Hand-out –**

Please write your name at the top of your "Revised Agenda" handout. A limited number of the handouts were made to have one (1) for each registered attendee, and last minute registrants. If you lose your handout, the registration desk will not be able to give you a replacement until the conclusion of the conference.

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*Please mark your calendars for the 2005 TACOM APBI, to be held October 26 - 28, in Dearborn, Michigan. To get the current details: conference agenda (featured speakers & break-out session information) conference registration fee information, etc., please link to our NDIA web page at:*

<http://register.ndia.org/interview/register.ndia?~Brochure~6520>

# Combat Systems

## Where We Are... Where We're Going...

22 Sep 2005

Larry D. Hollingsworth  
Colonel, Infantry  
Project Manager



*Make A Difference Everyday!*



# Combat Systems





# Purpose

**Orient you on the Ground Combat Component of the HBCT**

## **HBCT Fleet Strategy**

**Modularize  
Sustain  
Modernize**

**The Future**



# Program Executive Office Ground Combat Systems



Stryker  
Brigade  
Combat  
Team



Combat  
Systems

- Abrams Tank
- Bradley Fighting Vehicle
- Paladin / FAASV
- M113



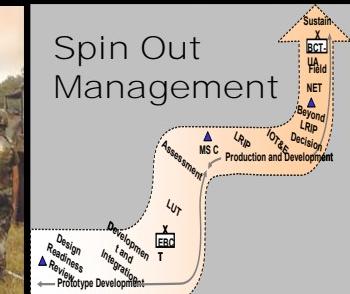
Joint Robotics  
Systems  
(Army & Marine)



Joint  
Lightweight  
Howitzer  
155mm  
(Army & Marine)



Modular  
Brigade  
Enhancements



PEO GCS maintains a total Army perspective in managing the development, acquisition, testing, systems integration, product improvement, and fielding that places the best ground combat systems in the hands of our soldiers



## Mission

***Deliver, Sustain and modernize combat power for the Army's Heavy Brigade Combat Team formations***

Army's Executive Agent for Life Cycle Management of the **Abrams, Bradley, M113, M109, and Knight** family of vehicles.

Our fleet management responsibilities include the design, development, production and fielding of safe, reliable, and lethal ground combat systems

*Our current focus **Supports Deployed Forces, Modularity, Reset, Recapitalization, Leave Behind Maintenance and Spin-Out Technology Insertion***

**Support the Fight \*\* Sustain the Fleet \*\* Build the Future**



## PM Combat Systems Leadership



**Abrams**  
PM LTC Michael Flanagan  
DPM Mr. Michael Martell



**Combat Systems**  
PM COL Larry Hollingsworth  
DPM Mr. Michael Asada



**Bradley / M113**  
PM LTC Andres Contreras  
DPM Mr. Ed Lewis



**Fire Support**  
PM LTC Pete Reyneirse  
DPM Mr. Marlin Carlsen



## Current Priorities

**Execute Reset for HBCT Platforms**

**Execute Modularity**

**Bradley-Abrams-Paladin Durability - Reliability  
(Bradley Transmission and Abrams Engine)**

**Process Improvement**

**Right-size the Organization**

**Our #1 Priority is to Support Units Engaged in  
GWOT and those Units Preparing to Deploy**



# Combat Systems



## The Systems We Manage

**6,046  
Abrams  
FoV**

M1A1  
M1A1 AIM



M104 Wolverine



M1A2 SEP



M2/3A2  
M2/3A2 ODS



M2/3A3



**6,659  
Bradley  
FoV**

BCV ODS  
BCV A3



C2V2

**1,895  
Paladins/  
FAASVs**

M109A6  
Paladin



M992A2  
(FAASV)



M7 BFIST



M3A3 BFIST



M1068A3



M113A3

**13,693  
M113  
FoV**

M577A3

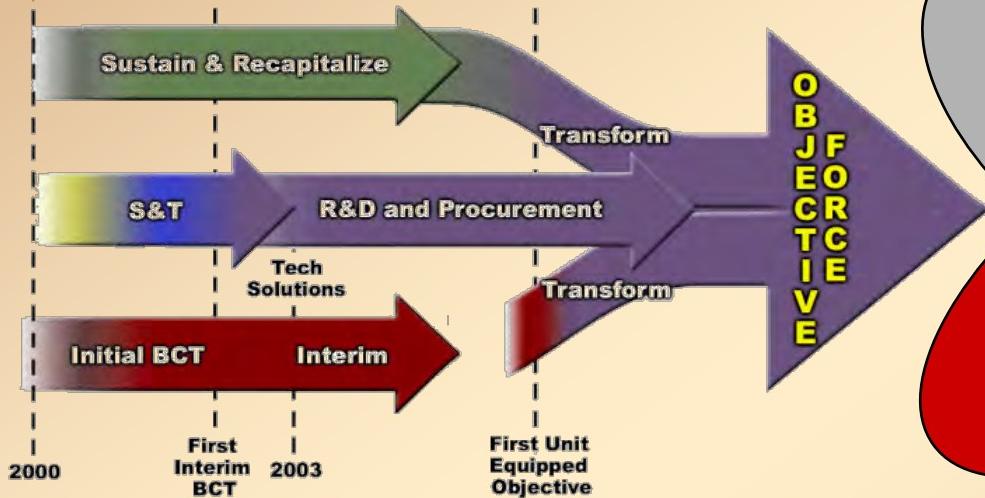


## Transformation

Legacy Force

Objective Force

Interim Force



FCS

IBCT

Transformation

HBCT

SBCT

- Integrates Heavy, Light, Stryker BCTs and FCS
- Delivers Complimentary War Fighting Capability

CURRENT

2005

20XX

FUTURE

20XX

20XX

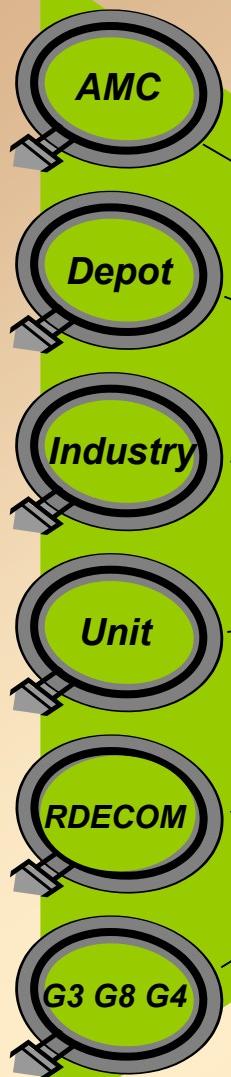
# Life Cycle Management within the Heavy Brigade Combat Team



***Make A Difference Everyday!***



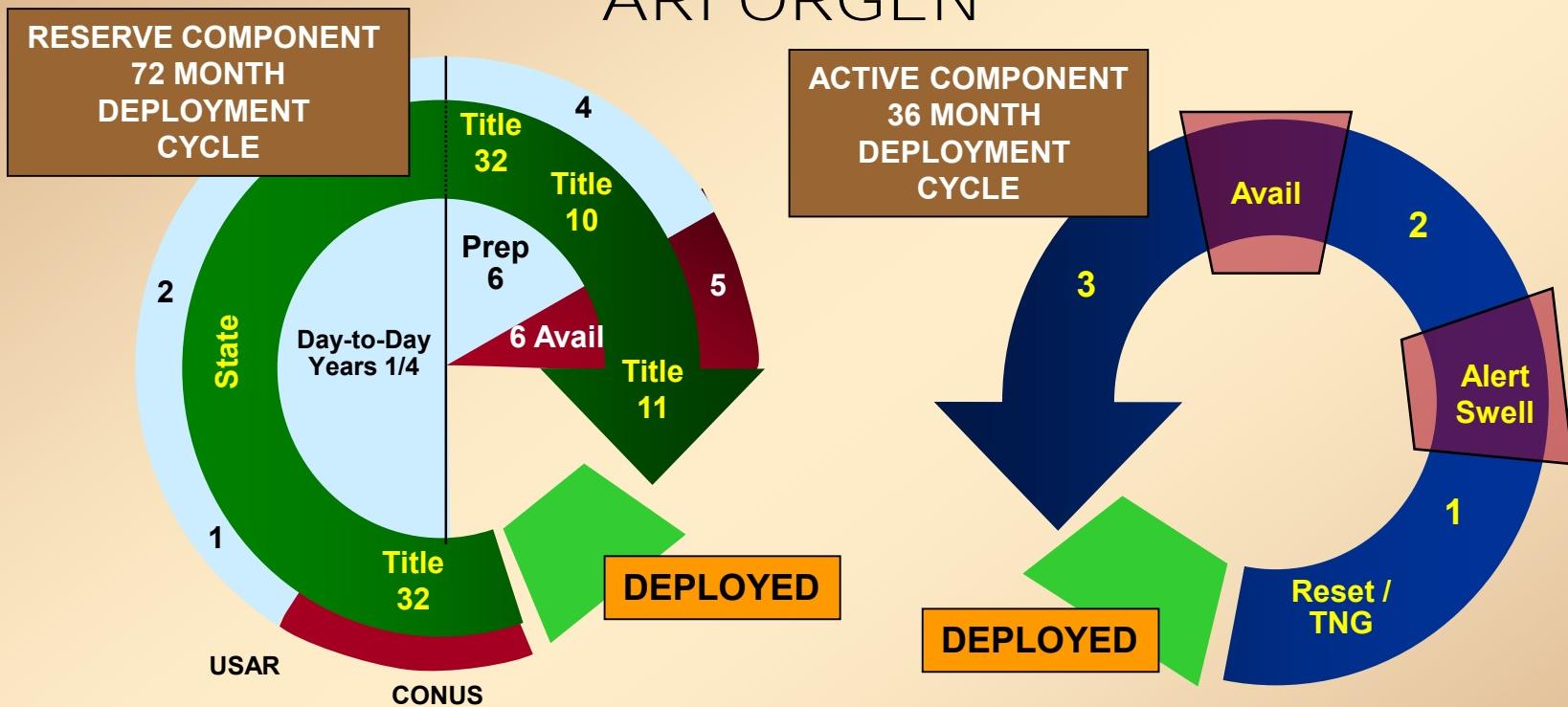
## Life Cycle Management Command



One Team One Vision



# Army Forces Generation Model ARFORGEN



**Synchronizes the Right Force Mix with the Right Equipment  
Mix at the Right Time**

**PM Objective is to “ONLY TOUCH THE UNIT ONCE”**



# HBCT Fleet Strategy



OPTEMPO

Modernize

Commonality  
Power Management  
Tiger Engine  
Bradley Transmission  
Digital Fire Control  
Lethality  
FCS Spin Outs

Sustain

STRESS  
STUDY



Heavy Brigade  
Combat Team

Modularize

ARMY CAMPAIGN PLAN

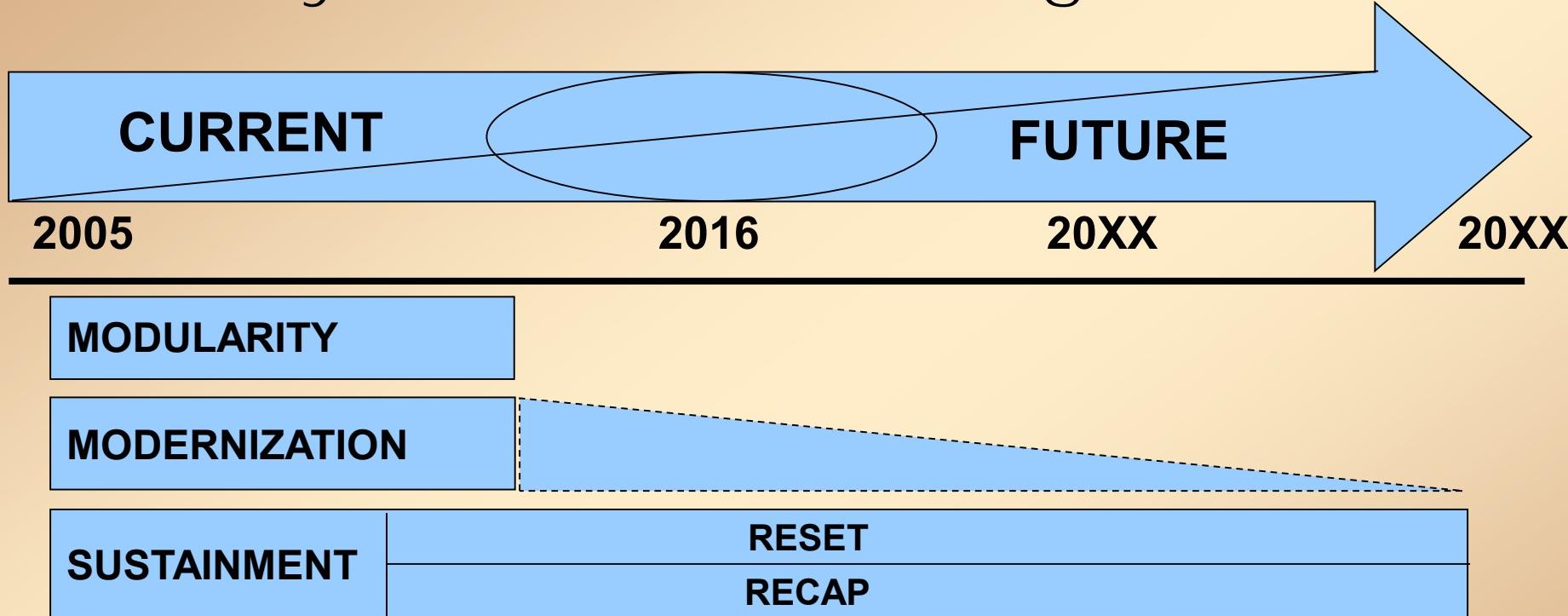
AGING  
FLEET

RESET  
RECAP  
Leave Behind Equip  
Stay Behind Maintenance

	FY04	FY05	FY06	FY07	FY08	FY09	FY10
UEx	■	■	■	■	■		
BCT (UA)	■	■	■	■	■		
UEX		●					
UAs	■	■	■	■	■	■	■
RESERVE	■	■	■	■	■	■	■
STRYKER	■ SECT2	■ SECT3	■ SECTA 172nd Round-Cut	■ SECTS	■ SECT5G		
Aviation	■	■	■	■	■		
FCS					Spin Out		Spin Out



## Synchronized Through 2050



- Requires Partnerships with Industry, FORSCOM and AMC
- Requires Centralized Management and Oversight
- Leverages Centralized Funds Management (OMA and PAA)
- Requires Balance between Current and Future Forces

# Modularity

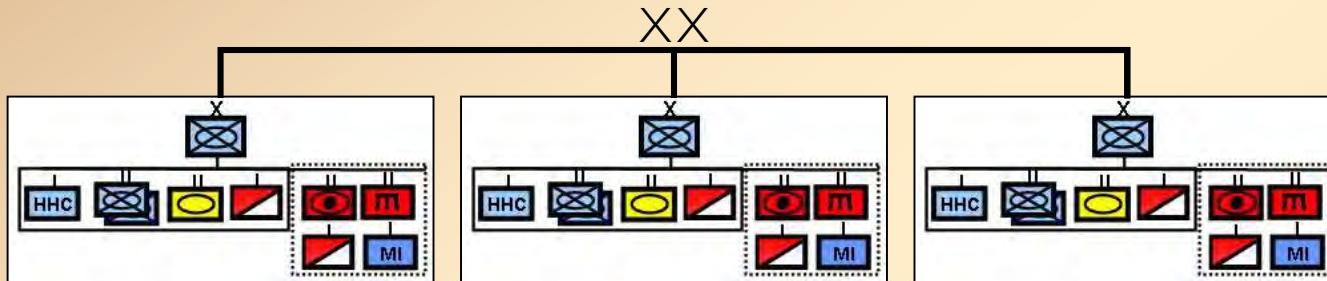


*Make A Difference Everyday!*

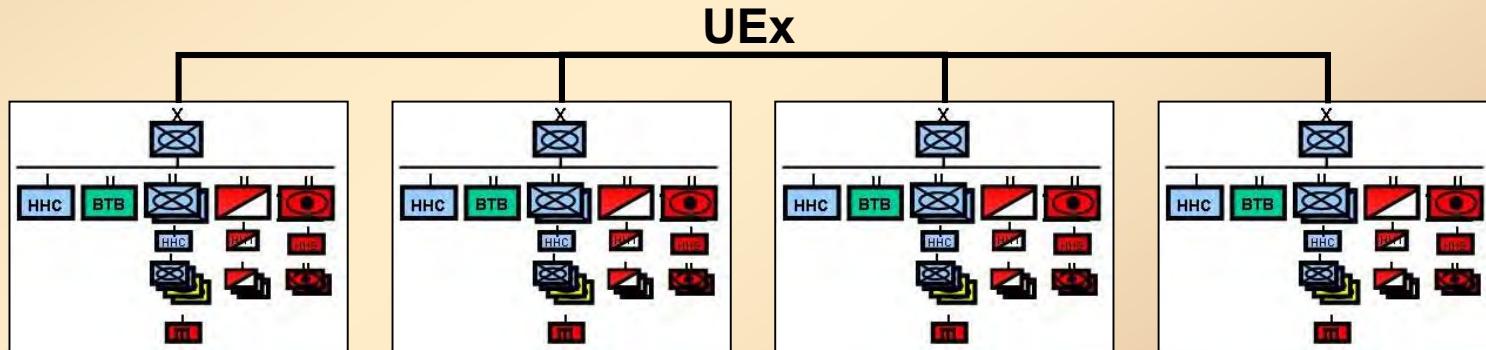


## From My Foxhole. . .

**Army of Excellence - Division Focused**  
**Large, powerful, fixed organizations**



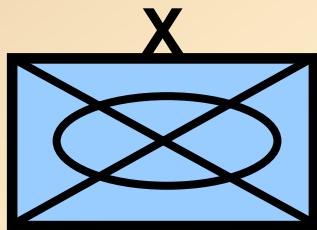
**Modularity – Brigade Combat Team Focused**  
**Modular, more deployable, more lethal, self-contained organizations**



**Build a campaign-quality Army with joint and expeditionary capabilities now to provide relevant and ready landpower. . .**



# Planning for a Heavy BCT

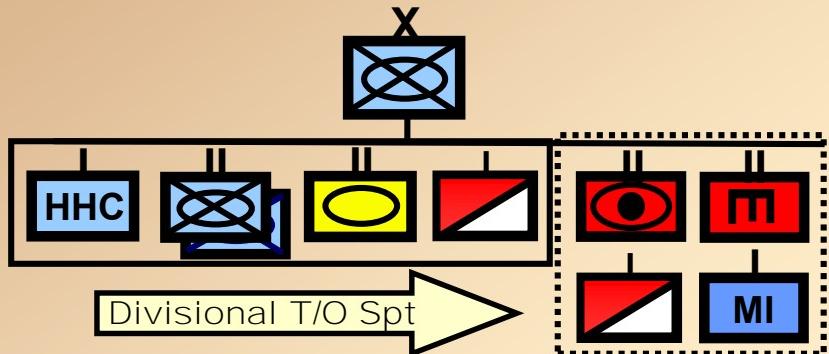


Type Location	BCT / ORF	In the Motor Pool	TRADOC	Battle Losses Test Facility Veh	Total Per BCT
<b>Abrams</b>	58 / 2	60	7	3	70
<b>Bradley FoV</b>	120 / 5	125	8	7	140
<b>M113 FoV</b>	119 / 4	123	7	4	134
<b>Paladin / FAASV</b>	16 / 1	17	1	1	19



# Army of Excellence vs Modular

Mechanized Infantry Brigade

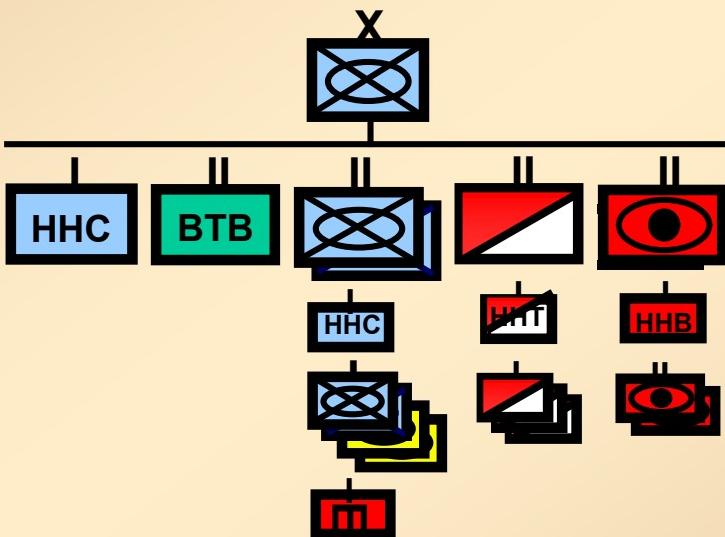


BDE

Div

Abrams	45	252
Bradley IFV	90	254
BFIST	9	
M113 FOV	165	522
Paladin/FAASV	19	57

Heavy Brigade Combat Team



BCT

UEx  
Equiv

Abrams	60	240
Bradley IFV	64	
Bradley CFV	30	500
BFIST	12	
ODS-E	19	
M113 FOV	123	492
Paladin/FAASV	17	68



# Projected Distribution of HBCT Combat Power

## Current Program of Record

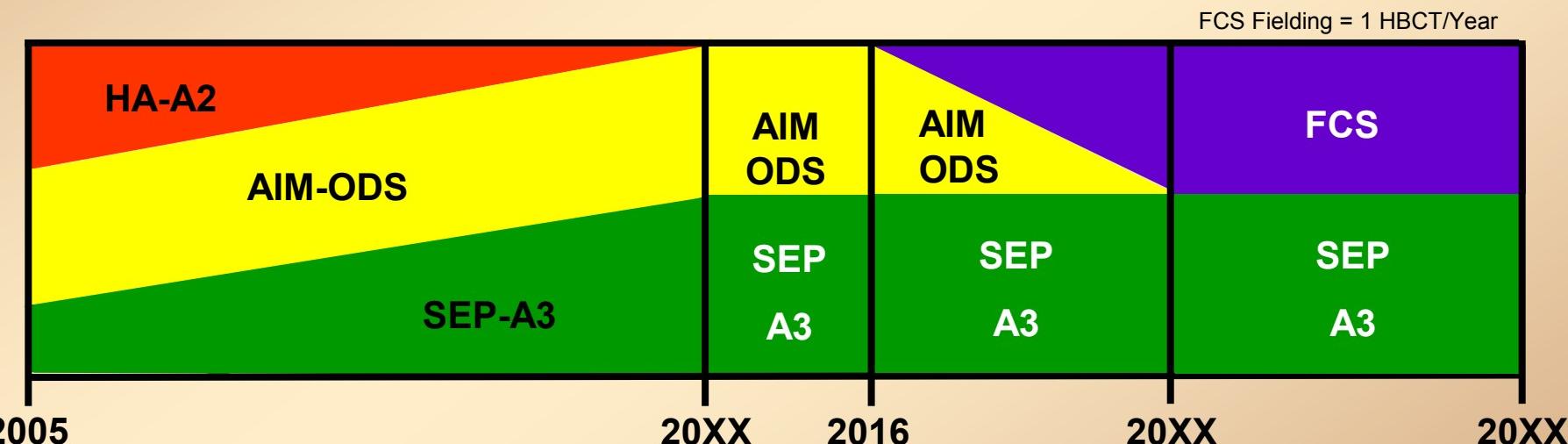
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**BASED ON CURRENT FUNDING EXECUTABLE**

## Moving Towards...

18-17

**BASED ON ARFORGEN MODEL SUPPORTS PURE FLEET GOAL**



**Goal: Two Variant Mixes**  
**M1A2 SEP & M2A3**  
**M1A1 AIM & M2A2 ODS**

# Sustainment



***Make A Difference Everyday!***



## Sustainment Goals

1. Improve Operational Readiness
  2. Reduce O and S Costs
- X. Manage Obsolescence
- X. Provide Base for Modernization
- X. Tech Insertion (Align with FCS)
- X. Maintain Fleet Age





# Sustainment

## Reconstitution:

- Restores vehicles to 10/20 status within specified period
- Conducted in Unit Motor Pool with Soldier Labor



## RESET (Motor Pool):

- Restores vehicles w/in Reset period (180 Days and 90%)
- Includes Delayed Desert Damage
- Includes some Lessons Learned
- Contract labor (QA/QC)



## National Level RESET:

- Includes Depot and OEM partnership
- Includes Turret – Hull separation
- Overhaul Engine, Transmission and Final Drives



## Recapitalization:

- Restores service life to 0 hours and 0 miles
- Improves Reliability and Maintainability

# Modernization



***Make A Difference Everyday!***



# March 11, 2003

**DEPARTMENT OF DEFENSE**  
**DEPARTMENT OF THE ARMY**  
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY  
ACQUISITION LOGISTICS AND TECHNOLOGY  
103 ARMY PENTAGON  
WASHINGTON DC 20310-0103

11 MAR 2003

SAAL-RI

MEMORANDUM FOR PROGRAM EXECUTIVE OFFICE, GROUND COMBAT SYSTEMS, ATTN: SFAE-GCS, WARREN, MI 48397-5000

SUBJECT: Fiscal Year 2003 (FY03) Termination Plans for Abrams SEP and Bradley A3 Programs

As stated in the enclosed Deputy Assistant Secretary for Plans, Programs, and Resources memorandum subject: Fiscal Year (FY) 2003 Funding Guidance, dated September 10, 2002, fiscal pressures and the Army's transformation plan resulted in multiple terminations during the Program Objective Memorandum (POM) FY04-09, including the Abrams SEP and Bradley A3 Programs. Accordingly, please prepare and submit individual termination plans by April 15, 2003. Do not terminate contracts until I have approved your submitted termination plans. You will have provided an official termination notice.

You are directed to provide the program manager with a copy of your termination plan by April 15, 2003. As part of each termination plan, you will identify:

- a. Contract status. Open contracts/amount(s)/type dollars. Also include descriptions of contracts, and contract related responsibilities / obligations. Address termination and/or modification of existing and unliquidated obligations. Identify the final date to terminate the program.
- b. Sustainment requirements. If the terminated sustainment activities (SSTS) and funding, ensure the proper coordination with the gaining organization to which management transferred.
- c. Personnel. Include proposed disposition of all military and civilian) and personnel involved in the termination, including the completion of closeout activities and those available for reassignment.
- d. Funding. Provide a lay-out of RDTE, Procurement, and other costs (if applicable) as submitted in the FY04 President's Budget. Portray how funds will be executed for terminating the program. Identify the obligation timeline and the associated activities/decisions required to execute the funds. Identify the total funding required, in FY03 dollars, to terminate this program.

e. Other significant events/activities, which must be completed prior to program termination (i.e. fielding, safety issues, material release, etc.) If the termination requires transition of technology and/or responsibilities, please incorporate these activities and ensure the termination plan has been appropriately coordinated.

f. A termination schedule identifying significant activities and events.

Additionally, you should be prepared to consolidate and archive relevant programmatic documentation, and determine the actions and requirements necessary to restart the program in the event this becomes necessary. Submit your termination plans to my Deputy Assistant Secretary for Plans, Programs and Resources.

Please accept and extend my appreciation to the Program Managers, and the staff, for their continued hard work and commitment to excellence. The Army's finest, the warfighters, have been, and will continue to be, equipped with state of the art equipment due to the technical expertise and professionalism your staff repeatedly displays.

**“SUBJECT: Fiscal Year 2003 (FY03)  
Termination Plans for Abrams SEP and Bradley  
A3 Programs**

**..... Please prepare and submit individual  
termination plans for approval.”**



# Modernization



TUSK  
TIGER Engine (AGT 1500)  
2<sup>nd</sup> Gen FLIR  
FBCB2  
Digital Architecture

Maintain Combat Overmatch



Urban Combat Kit  
Improved Transmission  
2<sup>nd</sup> Gen FLIR  
FBCB2  
Digital Architecture

Improve Survivability

Improve Lethality

Improve Power Management

Upgrade Electronics



Upgrade Power Train  
T-150 Track  
AoA Provisions  
Transmission  
Vehicle Intercom System

Integrate SoS Common Operating Environment (SOSCOE)



Implement Common Logistic Operating Environment (CLOE)

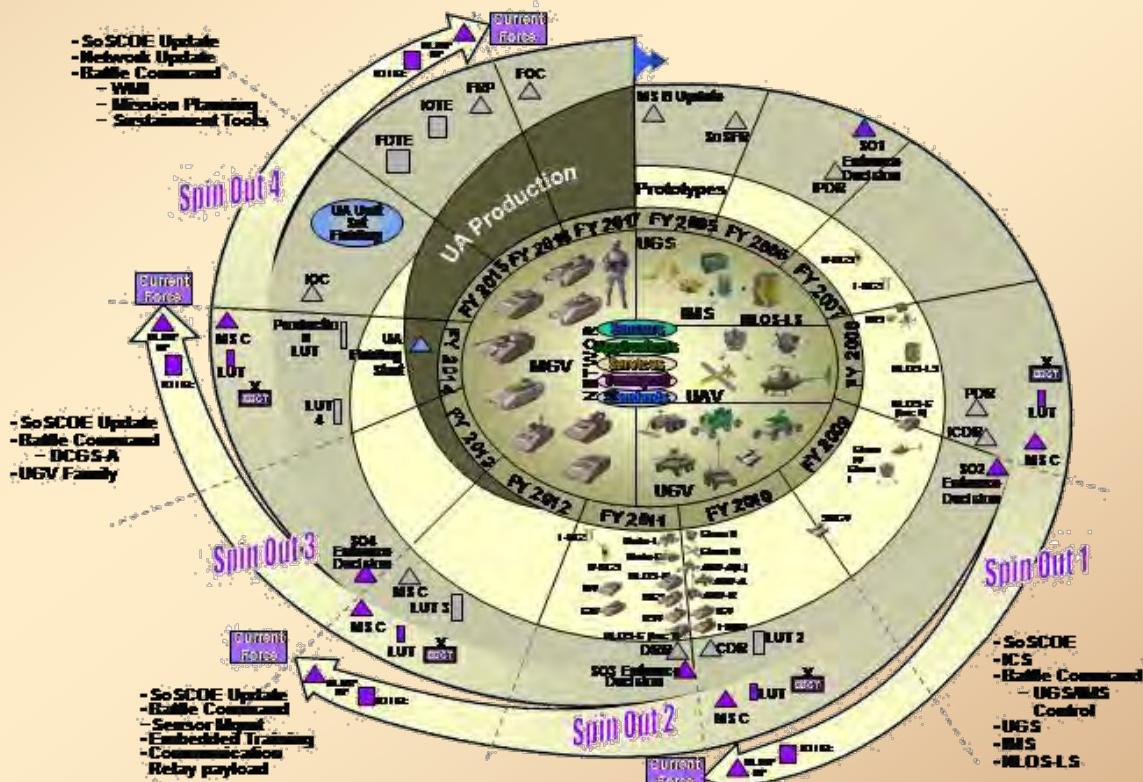


Digital Fire Control  
Modular Charge System  
Excalibur  
Auxiliary Power Unit  
FS3 Sensor Integration



# Long Term Modernization Objectives

- Compliment, Enable and Leverage FCS Spinouts
  - Reduce O&S Costs
  - Vehicle Electronics
  - Improved Crew Survivability
  - Manage Obsolescence
  - Common Logistics Operating Environment
  - Unit Identification Device



## **Current Force Requirements**

# Sustain

# Modernize

## Synchronize with FCS



## Summary

**PM Combat Systems is the LCM for HBCT**

**The HBCT is an integral part of Transformation both  
Near and Long Term**

**M2A3 and M1A2 Represent the EBCT Platforms for FCS  
Spinouts 1-4**

**Transformation must include a Current Force  
Modernization Strategy that Compliments FCS**



# Combat Systems



*FOUO*



## *ASV Program Overview*

*MAJ Stanley Scott  
APM, Armored Security Vehicle*

Phone: 586-574-8981

DSN: 786-8981

Cell: 586-764-5382

Email: stanley.scott@us.army.mil

*22 September, 2005*

*FOUO*



*FOUO*

# *Agenda*



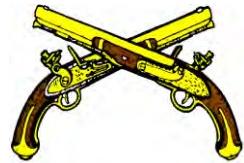
- ◆ ASV Introduction
- ◆ System Description
- ◆ ASV Capabilities
- ◆ ASV Fielding Plan
- ◆ Production Facts
- ◆ Challenges
- ◆ Performance in OIF

*FOUO*



*FOUO*

# *Armor Security Vehicle (ASV)*



The ASV is a wheeled vehicle that carries a MK-19 (40mm grenade launcher) and a M48 (.50-caliber machine gun). It is transportable aboard a C-130 and offers good protection against an array of threat.

Missions: local area security, mounted patrols, check points operations, convoy security, and response force operations.



*Greatly enhances the lethality, mobility,  
and survivability of units  
engaged in their security missions*

*FOUO*



# ***ASV Capabilities***

## Lethal

- M48 .50 CAL MG
- MK19 40mm grenade launcher
- Dual mounted weapons station
- SAW



## Survivable

- Heavy MG
- Anti-personnel Mine

## Mobility

- 63 mph/range 440 mile
- 60% slope
- 60" fording
- 24" step
- 18" ground clearance
- CTIS

## Deployable

- C-130 RO/RO; C-5 five ASVs
  - < 15 tons combat loaded

## Sustainable

- High MTBF (2410 hrs)
- 65% common with NSN Items

## Other

Superior ride quality from independent suspension



*FOUO*



# *Armor Security Vehicle Fielding*

## ◆ Fielding Team:

- PM Representative
- KoR Support
- MP School Representative
- Textron FSR

## ◆ Operator/Crew Training

- 40 hour OPNET/Range Training

## ◆ Maintenance Training

- 80 hour class

## ◆ Training Location:

- Camp Anaconda (Balad), Iraq

## ◆ 155 in theater



*FOUO*



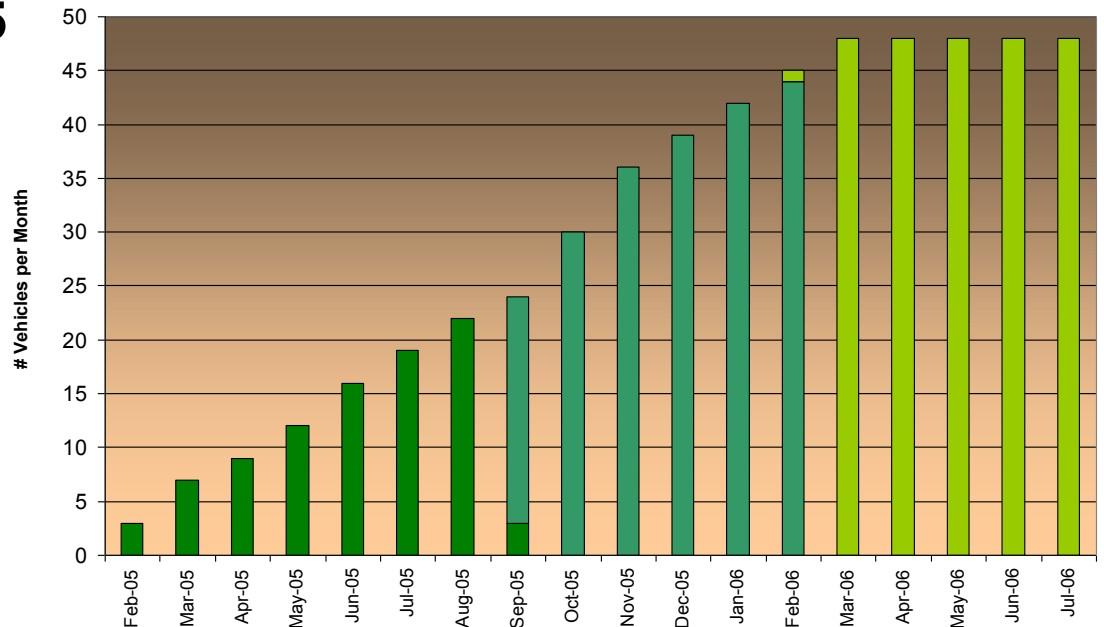
*FOUO*



# *Production Facts*

- ◆ Total on Contract thru Jul 05 – 1,118
- ◆ Production ramp up 2005 include:
  - New Blast and Paint Facility built at Main Shipyard Facility
  - Expanded ASV Structural Production
  - Final Assembly moved to Slidell
- ◆ Production Rate Objectives
  - 36/month by Nov 05
  - 48/month by Mar 06

*Pre-Katrina*



*FOUO*



## *Challenges*

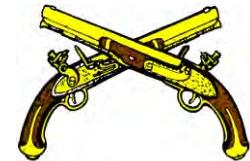
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- ◆ Slidell Facility – Final assembly sustained minimal damage.
  - Power restored.
  - Cleaned and operational
  - Workforce being re-established
- ◆ New Orleans Main Shipyard Facility – sustained damage, but ramping up quickly
  - Generators on site to support power restoration
  - Cleaning underway
  - Access between facilities is available



*FOUO*

# MANSCEN FUTURES CENTER MILITARY POLICE DIVISION OPERATIONAL EMPLOYMENT



**LTC Steve M. Herold**  
Director Combat Develop



*FOUO*



# MANSCEN FUTURES CENTER

## MILITARY POLICE DIVISION

### OPERATIONAL EMPLOYMENT

- FORCE PROTECTION ( VIP ESCORT)
- INCREASE PROTECTION, PROVIDES TACTICAL OVER WATCH FOR CIVILIAN AND MILITARY POLICE OPERATION(SECURITY OF IRAQI POLICE STATIONS)
- COMBAT RAIDS AND RECON/SURVEILLANCE
- QUICK REACTION FORCE AND SUPPORT BY FIRE
- CORDON AND SEARCH OPERATIONS
- CONVOY SECURITY KEEPING MSR'S OPEN
- FORWARD OPERATING BASE SECURITY
- CHECK POINT SECURITY
- CRITICAL SITE SECURITY

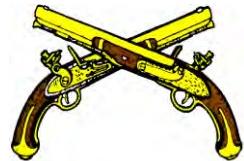








*FOUO*





## Manned Ground Vehicles (MGV) NDIA Combat Vehicle Symposium

COL Chuck Couteau and Dick Williams

22 September 2005

# Purpose

**The purpose is to provide an overview of the FCS Program and information on the current Manned Ground Vehicle design concepts and key design challenges**

# Agenda

- Manned Ground Vehicles Overview
- Best Technical Approach
- Survivability
- Lethality
- Propulsion
- Component Maturation/Reliability Availability Maintainability (RAM)

# Leading Transformation

- The US Army “At War and Transforming”
  - 781,000 to 480,000 active duty since 1990
  - Forces currently deployed in 120 countries
  - Simultaneous current and future “needs”
  - A campaign-quality Army with Joint and expeditionary capabilities
    - Joint *Interdependence* not just Interoperable
    - Expeditionary operations will be the norm
- FCS: Transformation in Multiple Dimensions
  - Warfighting, logistics, technology, business



General Peter J. Schoomaker  
 Chief of Staff, U.S. Army

\*General Schoomaker  
 Congressional Testimony  
 21 July 2004

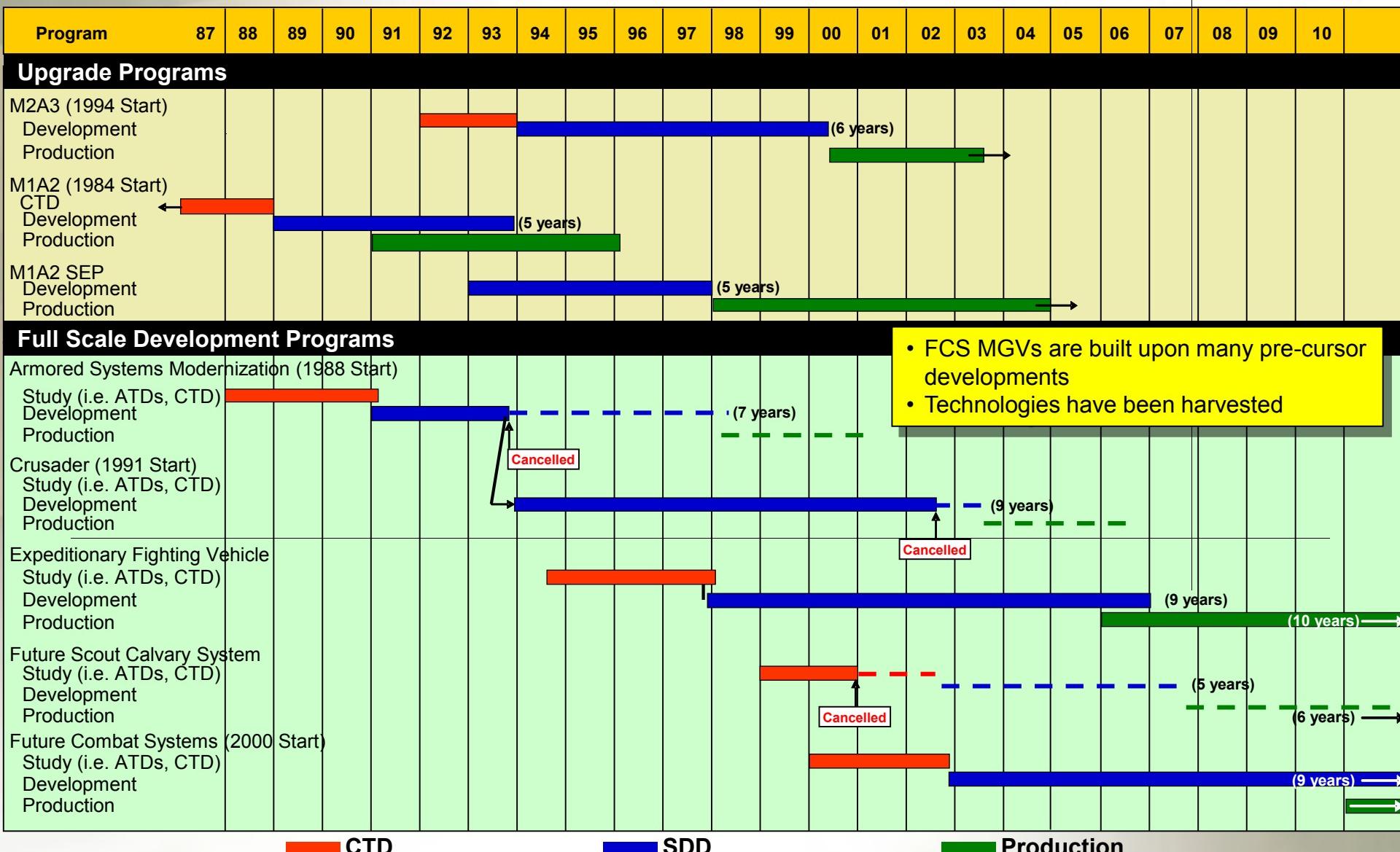
**“The best way to anticipate the future is to create it!”**

\*

# Objective Tiger Video



# Historical Perspective of Development Schedules



FCS Development Schedule is Consistent with Past Single Platform Development Programs

# FCS MGV Technology Leveraging FSCS Crusader



- Hybrid Electric Drive
  - Band Track
  - Active Suspension
  - Sensor Mast
  - Active Track Tensioner
  - Lithium-Ion Batteries
  - Crew Station
  - Propulsion Control Algorithms
  - High-power generator, motor and inverters
  - Modular Armor
  - Structures & Composites
  - Dynamic Physics Models



## **Infantry Carrier Vehicle**



## **Reconnaissance and Surveillance Vehicle**



NLOS – Mortar  
Vehicle



## **Mounted Combat System**



NLOS – Cannon  
Vehicle



Recovery and  
Maintenance Vehicle



## Command and Control Vehicle



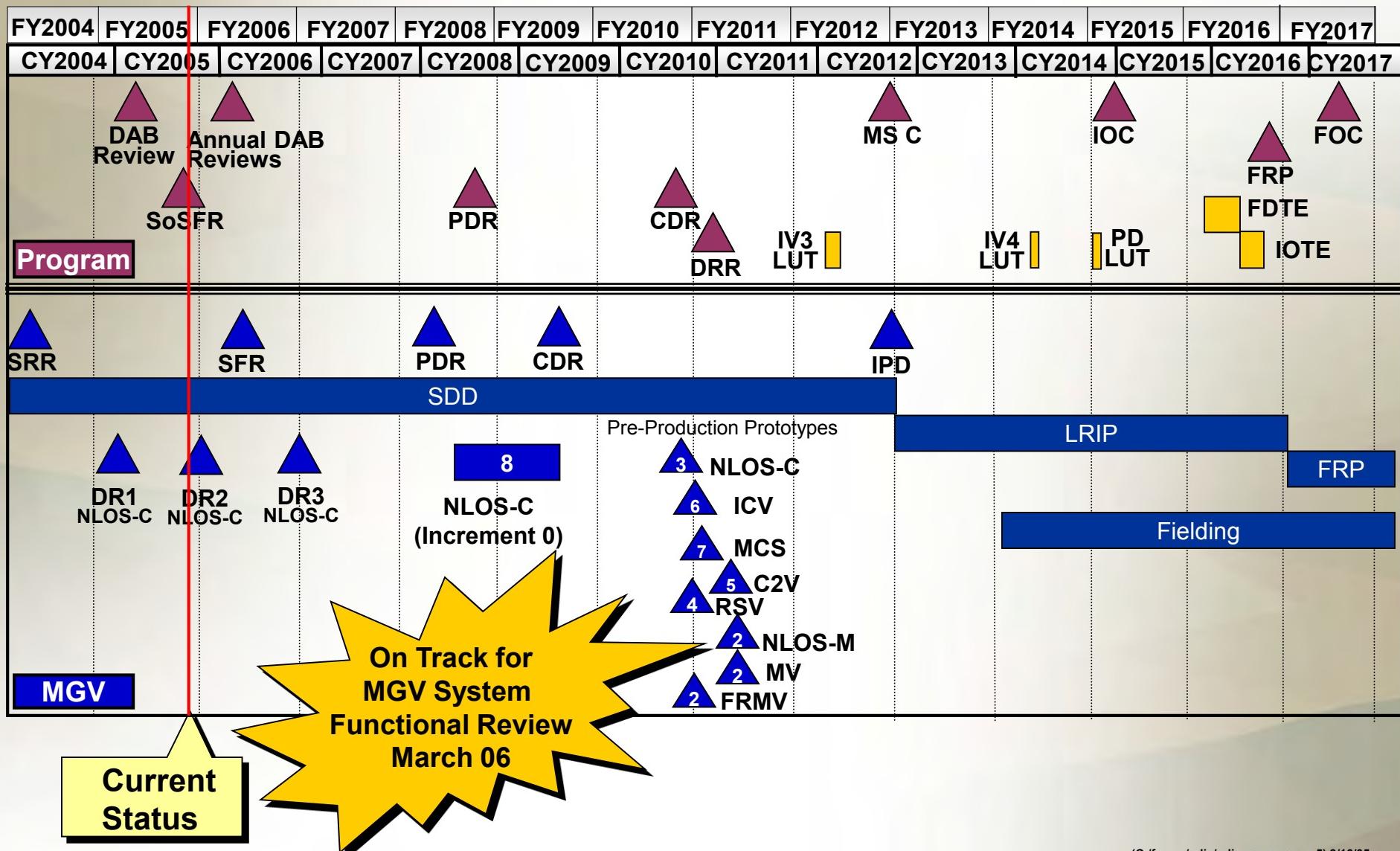
## **Medical Treatment/ Evacuation Vehicle**



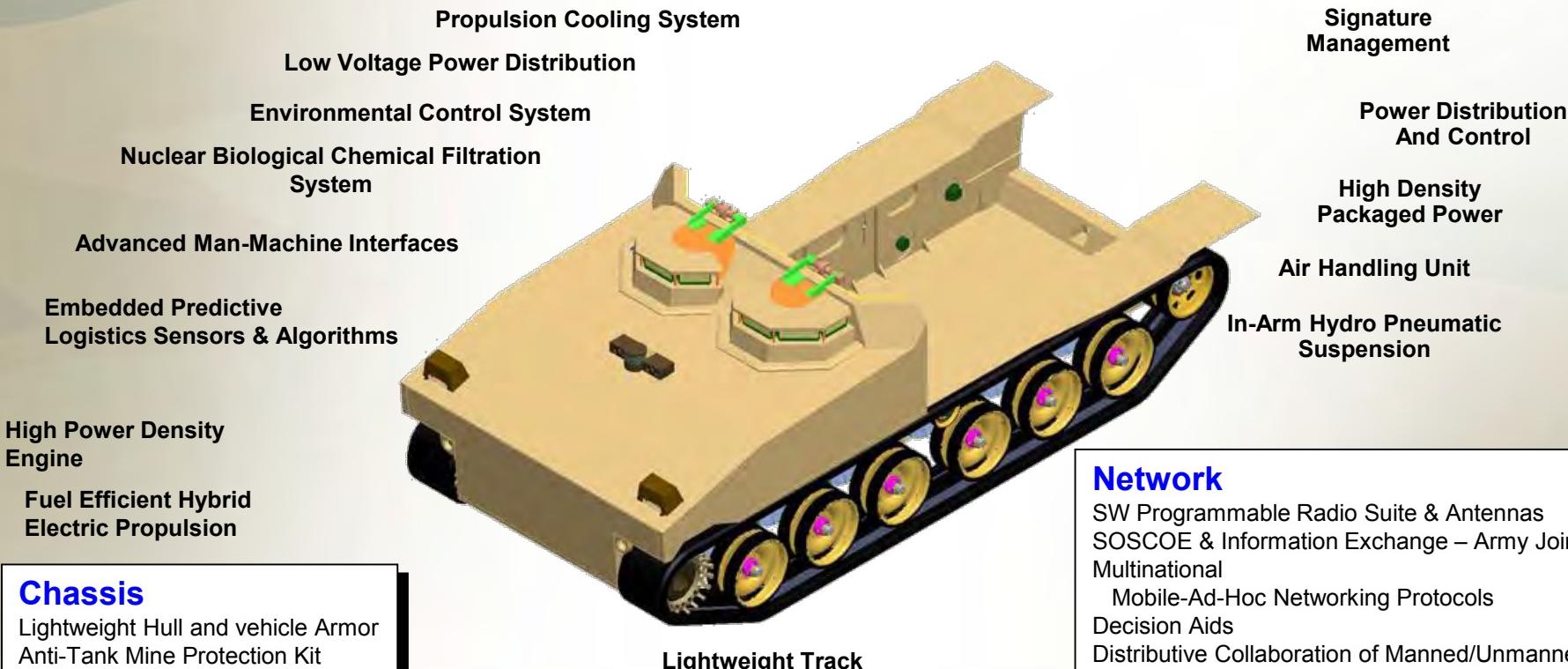
- Auto Ammo Handling
  - Auto Cannon Cooling/Cleaning
  - Laser Ignition
  - Projectile Tracking System
  - Signature Management
  - Drive-by-Wire
  - Bore Hazard Sensor
  - Structures & Composites
  - Dynamic Physics Models
  - Virtual Integration Lab
  - Application Software
  - Real-Time Common Operating Environment
  - IFTM Authoring System

- Composites
  - Titanium Heat Exchangers
  - Production Processes & Materials
  - Warfighter Machine Interface
  - 3<sup>rd</sup> GenFLIR
  - Performance Based Logistics

# Top Level Schedule (PM UA & MGV Extract)



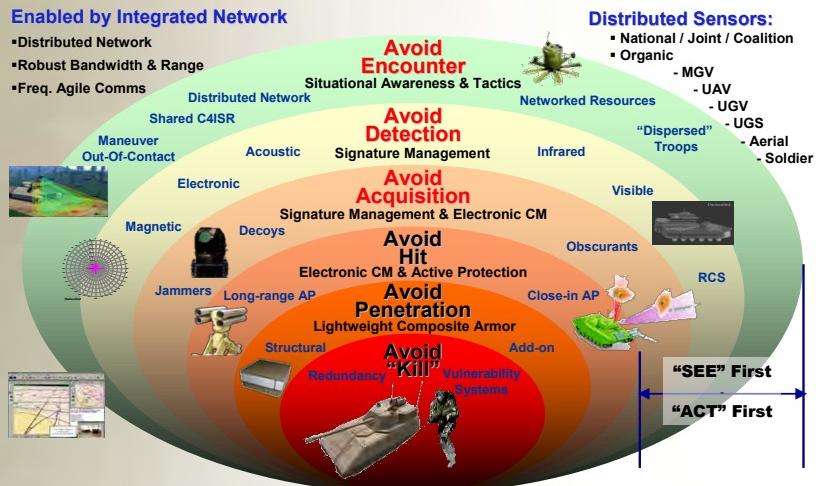
# Common Systems



70-80% Commonality Reduces O&M Cost  
70% of MGV AUPC on average are common sub-systems

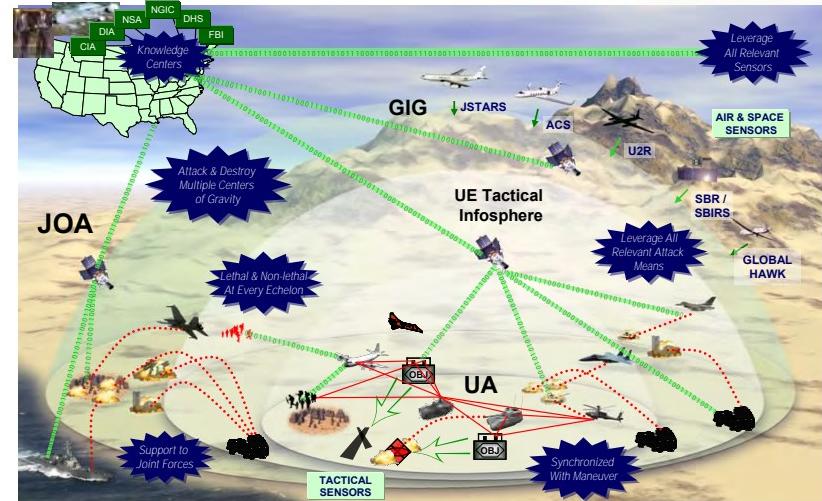
# MGVs Provide Networked Lethality and Survivability Within the UA

## Networked Survivability

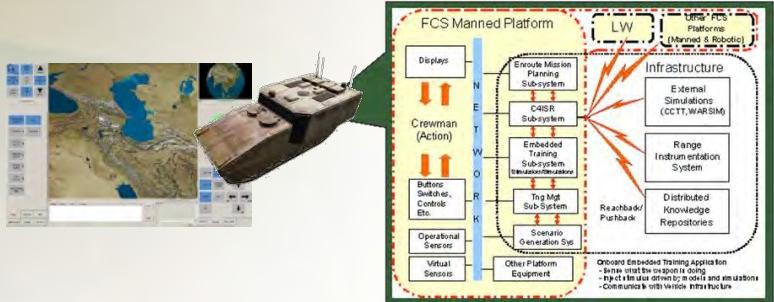


Even if all else fails, the FCS platforms are more survivable than current armored vehicles

## Networked Lethality



## Networked Training



**Objective:** Train all individual, crew, collective and leader tasks using embedded training on their **assigned** (go to war) **vehicle.... Enroute Mission Rehearsal / Planning...**

"Approved for Public Release, Distribution Unlimited, TACOM 13 Jan 2005, FCS Case 04-150"

## Networked Supportability

### Logistics Concept

- ✓ Network Enabled
- ✓ Performance Based (PBL)
- ✓ Distribution Based
- ✓ Common Operating Picture
- ✓ Anticipatory / Predictive / Reduced Footprint

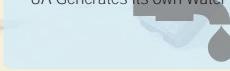
### Maintenance

- Substantially Increased Reliability and Availability
- Maximum Commonality of Components
- Common Electrical Connectors
- Prognostic / Diagnostic Sensors Integral to Platforms and Soldiers
- Immediate Access to Remove / Replace Modular Components
- Interactive Electronic Technical Manuals Embedded on Platforms



### Water

- UA Generates its own Water



### Fuel

- Lighter Vehicles
- Energy Efficient Drive Train



### Munitions

- Networked Lethality - Targeting and Firing
- Smart Munitions



"Approved for Public Release, Distribution Unlimited, TACOM 13 Jan 2005, FCS Case 04-150"

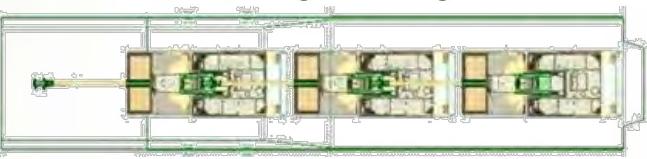
**MGV is the Host and Point of Presence for Majority of UA Capabilities**

# Balancing Capabilities

## Mobility



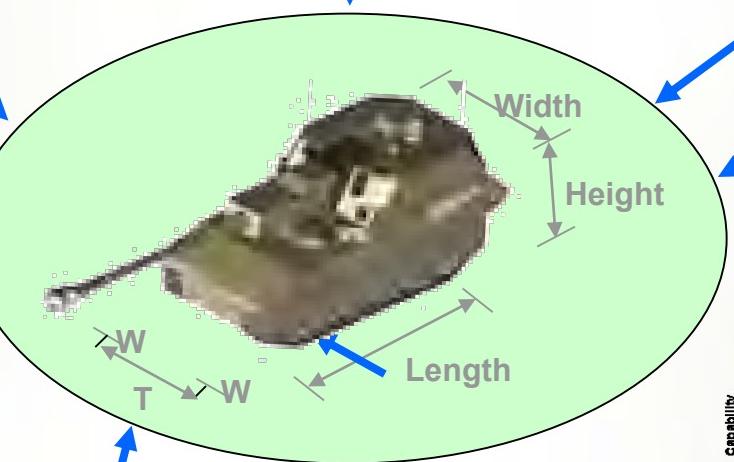
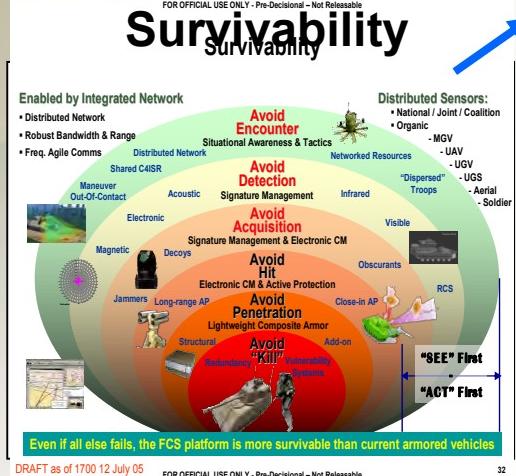
## Deployability



## Lethality



## Survivability



## C4ISR



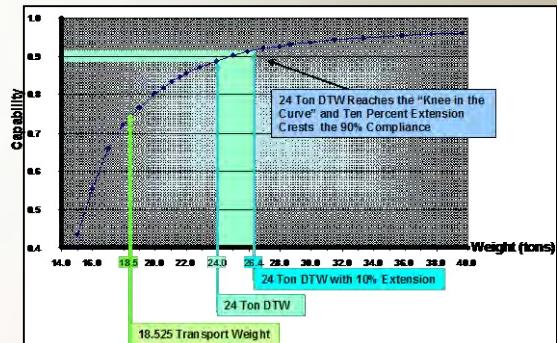
## Sustainment



- Integrate:
- Soldier
- C4ISR
- UAV
- UGV

- Training
- Lethality
- MANPRINT
- Comp Prog
- Supportability

## Space/Weight/Power



Convergence of BTA with Requirements will yield Performance Baseline at SFR

# FCS MGV Current Procurements

- Band Track
- Engine
- Traction Drive System
- Environmental Control System
- Energy Storage
- Generator
- Active Protection System
- Energy Dissipater

- High Power Distribution Bus
- Road Arm Assembly
- DC-DC Converter Power Stage
- Crewman Remote Interface System
- Servo Motor Controllers
- MCS 120mm Gun and Ammo Handling System

# MGV Commercial Off The Shelf (COTS)

Servo Motors



Oxygen Concentrator

Gear Boxes



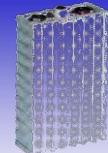
MV-T External Shelter

Cooling Fluid Elect. Valves



Blood Refrigerator – 10 Unit Storage Cap.

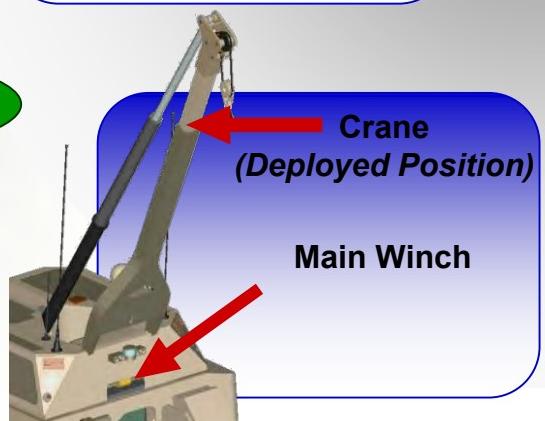
Bearings



Nickel Metal Hydride Battery

Solenoids

Electrical Connectors



Mission Electronic Motors

Proximity Sensors

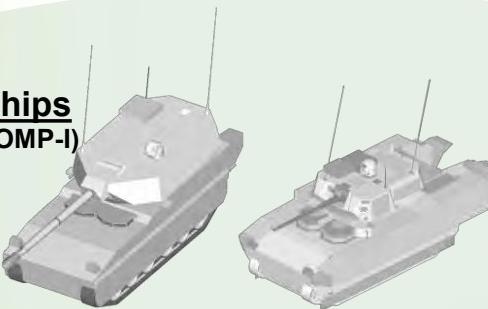
Cooling Fluid Manifolds

This represents some of the COTS products that are being considered

# Complementary Programs with MGV Relationships

## CPs with Other Relationships

SecureEnrouteCommsPkg (SECOMP-I)  
Soldier as a System  
OneTESS  
JTRS Cluster 5  
NDL (JTRS waveform)  
WNW (JTRS waveform)  
SRW (JTRS CL5 waveform)



## CPs as Munitions Fired

Med Range Mun(MRM) 120mm BLOS  
Excalibur 155mm  
Non-lethal 155mm  
PrecGuided MortarMun (PGMM 120mm)  
Course Correcting Fuse (CCF)

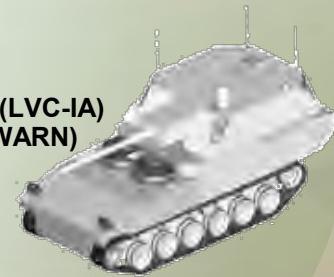


JTRS Cluster 1  
Warfighter Information Network -Tactical (WIN)  
LtwtLaserDesig/Rng(LLDR)  
Medical Communications (MC4)  
AN-PSS-14 (HSTAMIDS)  
Combat ID  
Joint Bio PointDet Sys (JBPDs)  
Joint Chemical Agent Detector (JCAD)  
Jnt Serv Ltwt Standoff ChemAgt Det(JSLSCAD)



## CPs as Installed/Carried Components

Dist Common Ground Sys-Army (DCGS-A)  
One Semi-Auto Forces(OneSAF)  
Common Training Inst Arch (CTIA)  
Army Training Info Arch (ATIA)  
Synthetic Envir Core-(SECore)  
Live Virtual Const Integrating Arch (LVC-IA)  
JointWarning+ReportingNetwork(JWARN)  
Battle Command SustSys (BCS3)  
Common Embed Diagnostic (CED)  
Global C2 Sys Army (GCSS-A)



## CPs as Weapons Mounted

ACSW XM307 25mm Cannon  
MK44 30/40mm Cannon

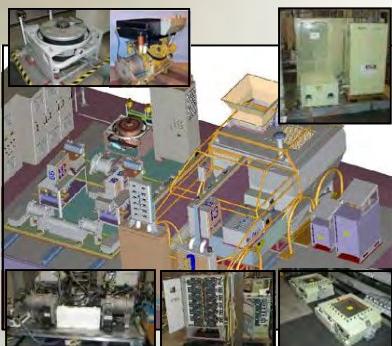


# MGV Summary



IAAPS

BAND TRACK



HYBRID ELECTRIC TESTING

- Design Processes On track for MGV SFR (March 06)
- Optimizing Current Concepts to achieve a Balanced Set of Capabilities
- Actively managing our program challenges



SIKA MAST TESTING



NLOS CANNON



120MM CANNON



**FUTURE COMBAT SYSTEMS**



*One Team-The Army/Defense/Industry*

**MGV**

**Best Technical Approach**

**Dan Holtz**  
**Lead System Integrator**  
**MGV Lead Engineer**

- BTA Objectives

- Conduct trades/analyses to identify system solutions/options that meet SoSS Rev E (ORD 1.2) changes
  - Update Common/Variant system concepts and SWAP-C data with possible solutions for customer input
  - Develop subsystem solutions/options using system guidance
  - Prepare solutions for MGV SFR

- BTA Assumptions

- QFR 11/04 is baseline configuration at 24T DTW
  - SoSS Rev E is document used for identification of PIDS gaps

- BTA Approach

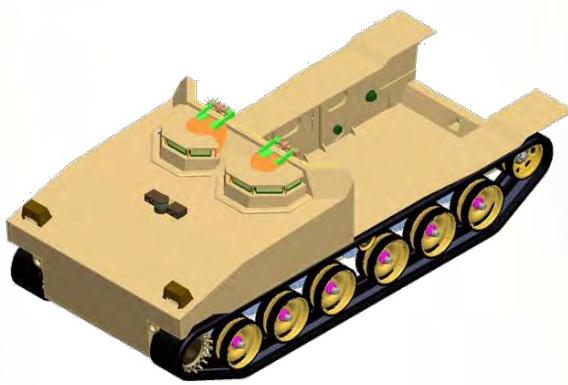
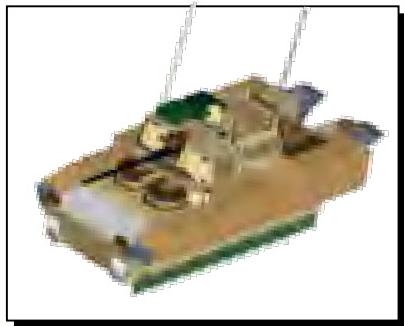
- ✓ Identify PID gaps
  - ✓ Establish BTA guidance
  - Identify system solutions/options
  - Identify subsystem solutions/options
  - Communicate solutions/options to user for input

# TRADOC Priorities

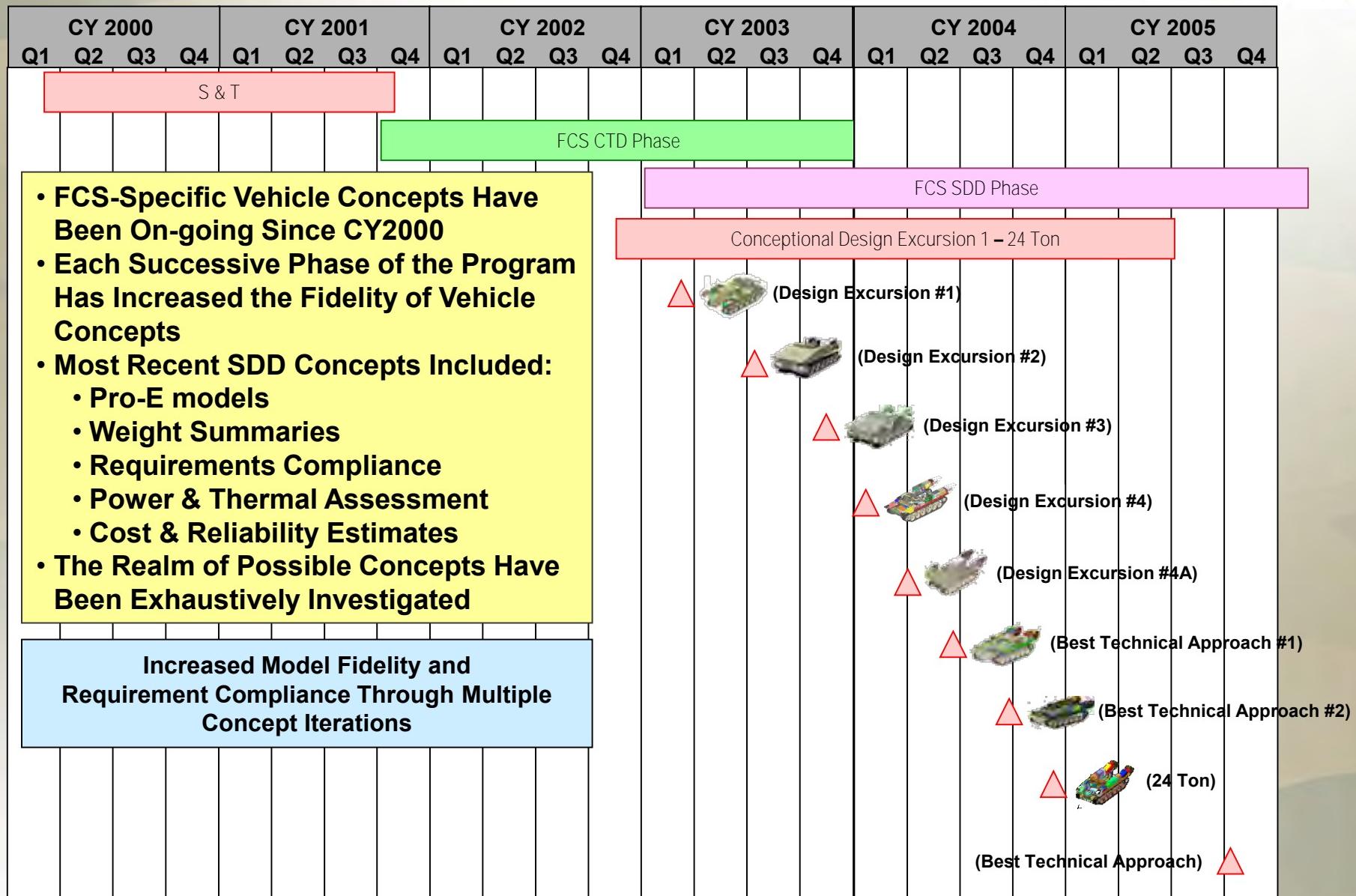
- Initial MGV Efforts utilized ORD Banding as the primary criteria for prioritization
- When GEN Byrnes issued the TRADOC Priorities, MGV used them within ORD bands as an additional criteria
- TRADOC Priorities
  - C-130 Transportable
  - Crew Survivability
    - Auto Cannon, HMG, HE Frag, AP
  - Lethality/Mission Equipment
  - Sustainment
    - Ao, Reliability, Resupply
  - Mobility



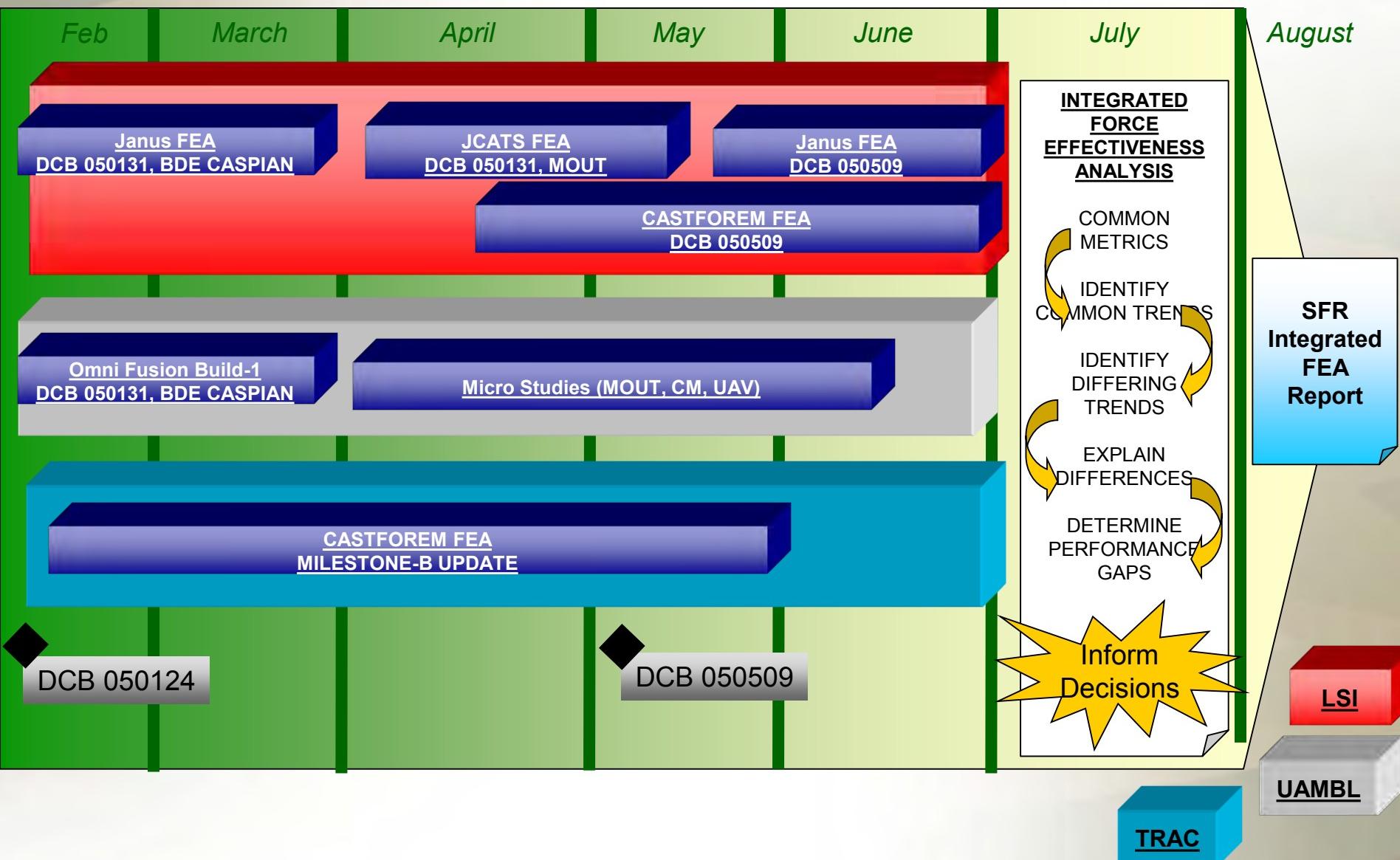
# Manned Ground Vehicles Family



# Historical Chronology of FCS Vehicle Design



# Force Effectiveness Analysis Methodology



# Post SoSFR Focus Areas

- Analysis

- SA/SU on Enemy in Difficult Postures and Hide
- Mine Detection
- Unmanned Vehicle Employment
- Network Capability
- Logistics Footprint and Re-Supply Concept

*Exploring full use of SoS, TTPs, and our analysis tools to ensure full understanding of DCB capabilities and potential performance improvements*

## Funding

- Lethal and Non-Lethal Munitions

*Some specified lethal and non-lethal munitions included in the DCB and related analyses are not funded*

*IPTs evaluating design alternatives*

## Materiel

- AT Mine Protection
- Gap Crossing

**To meet System SFR and SoSIPDR needs**

# Manned Ground Vehicles

## Best Technical Approach Objectives

### Objectives

- Move variant baseline toward compliance with Jan. '05 ORD
- Resolve inter-related competing space claims
- Establish Variant Zones
- Obtain Customer Concurrence for Variant Concept changes

### Objectives

- Obtain balanced approach at sub-system
- Establish SWAP-C and Design to cost targets



### High Priority Analysis

- Engine compartment
- Low-Profile Crew Station
- AT Mine Protection
- A&B Armor Solution
- Mission Critical Ballistic Protection
- Engine Exhaust/ Cooling
- Crew hatches

### Second Group of Analysis

- Internal Fuel Volume
- Suspension (12" – 8" of request)
- Spall Protection
- Split NBC Solution
- Sub-System SWAP-C
- Hull Structure (Alum. vs. Ti)

## Balance

## Communicate

## Iterate



*One Team-The Army/Defense/Industry*

## **Survivability Technologies**

### **Integrated Survivability: Active and Passive Protection**

**Mike Zoltoski  
Technical Director  
US Army RDECOM-TARDEC**

# Baselines: Abrams / Bradley Fighting Vehicle

Kill Enemy  
Before  
Detected



Abrams: 120mm Tank Cannon  
 Bradley: ATGM  
 25mm Automatic Cannon



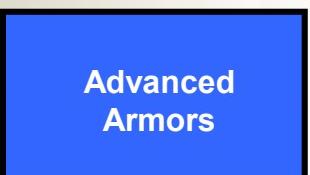
Don't Be  
Detected  
Don't Be  
Acquired



Don't Be  
Hit



Don't Be  
Penetrated



Abrams: Advanced Armors  
 Bradley: Reactive Armor/Metallic Armors

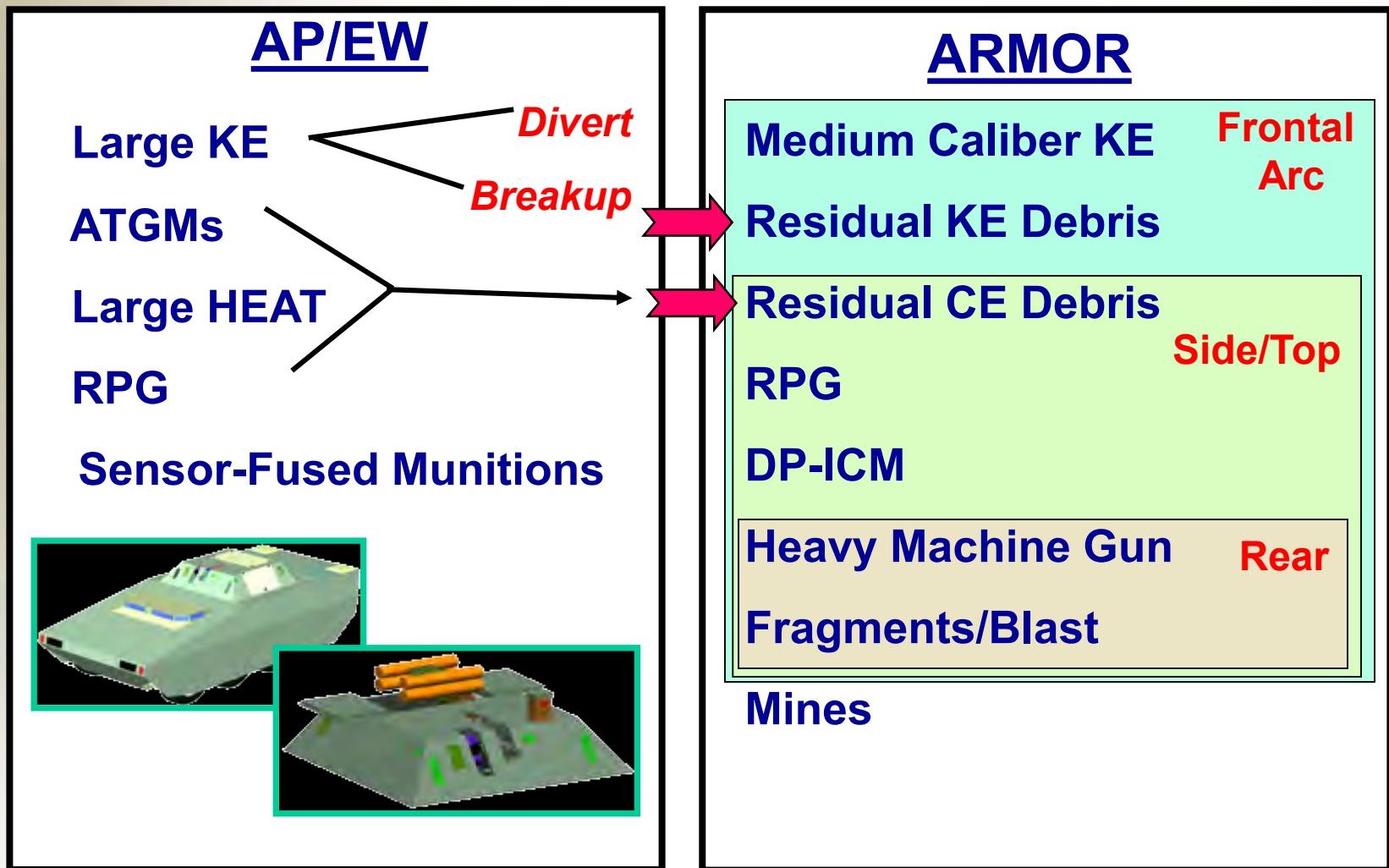
Survive  
the Hit



Abrams: Ammunition Compartmentation  
 Bradley: Ammunition Stowage



# An Integrated Protection Scheme



# Future Integrated Survability

Kill Enemy  
Before  
Detected

Local  
Situational  
Awareness



Lethality Suite  
Sensors  
C4ISR

Don't Be  
Detected  
Don't Be  
Acquired

Signature  
Management



Signature Treatments  
Multi-Spectral Obscurants

Don't Be  
Hit

Electronic  
Warfare/Active  
Protection  
Systems



Electronic Warfare  
Active Protection System (Long Range)  
APS (Close-in)

Don't Be  
Penetrated

Advanced  
Armors



Passive Armor  
Electromagnetic Armor

Survive  
the Hit

Crew  
Protection  
Systems



Fire Suppression  
Shock Mounting, Mine Protection

# Detection Avoidance – Signature Management

Kill Enemy  
Before  
Detected

Local  
Situational  
Awareness

Don't Be  
Detected  
Don't Be  
Acquired

Signature  
Management

Don't Be  
Hit

Electronic  
Warfare/Active  
Protection  
Systems

Don't Be  
Penetrated

Advanced  
Armors

Survive  
the Hit

Crew  
Protection  
Systems

- Shaping
- Materials
- Coatings
- Deception
- Modeling and Simulation Development Tools

# **Active Protection/Electronic Warfare**

# Kill Enemy Before Detected

## Local Situational Awareness

**Don't Be**  
*Detected*  
**Don't Be**  
*Acquired*

# **Signature Management**

## **Don't** *Be Hit*

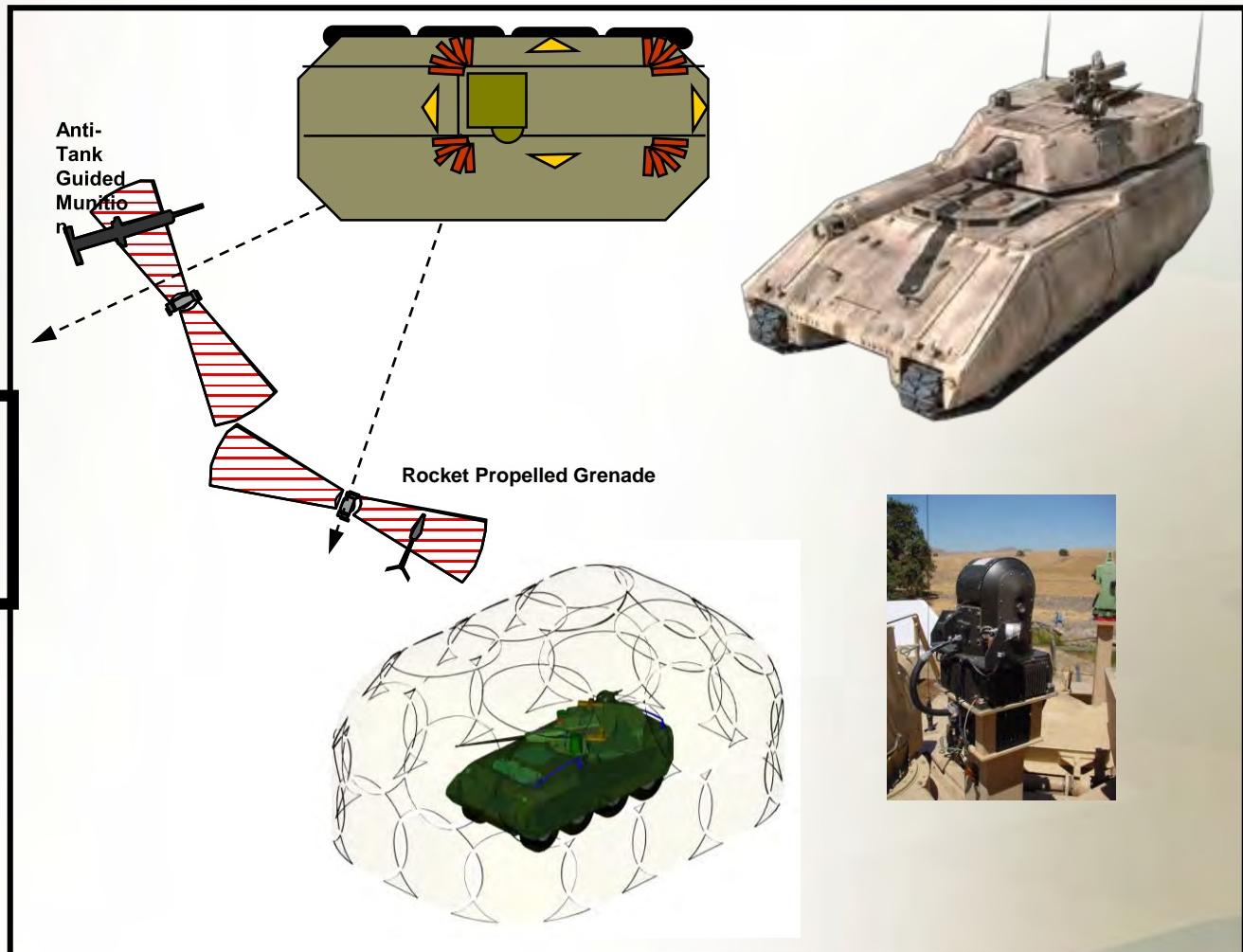
## **Electronic Warfare/Active Protection Systems**

## **Don't Be** *Penetrated*

## Advanced Armors

## Survive the Hit

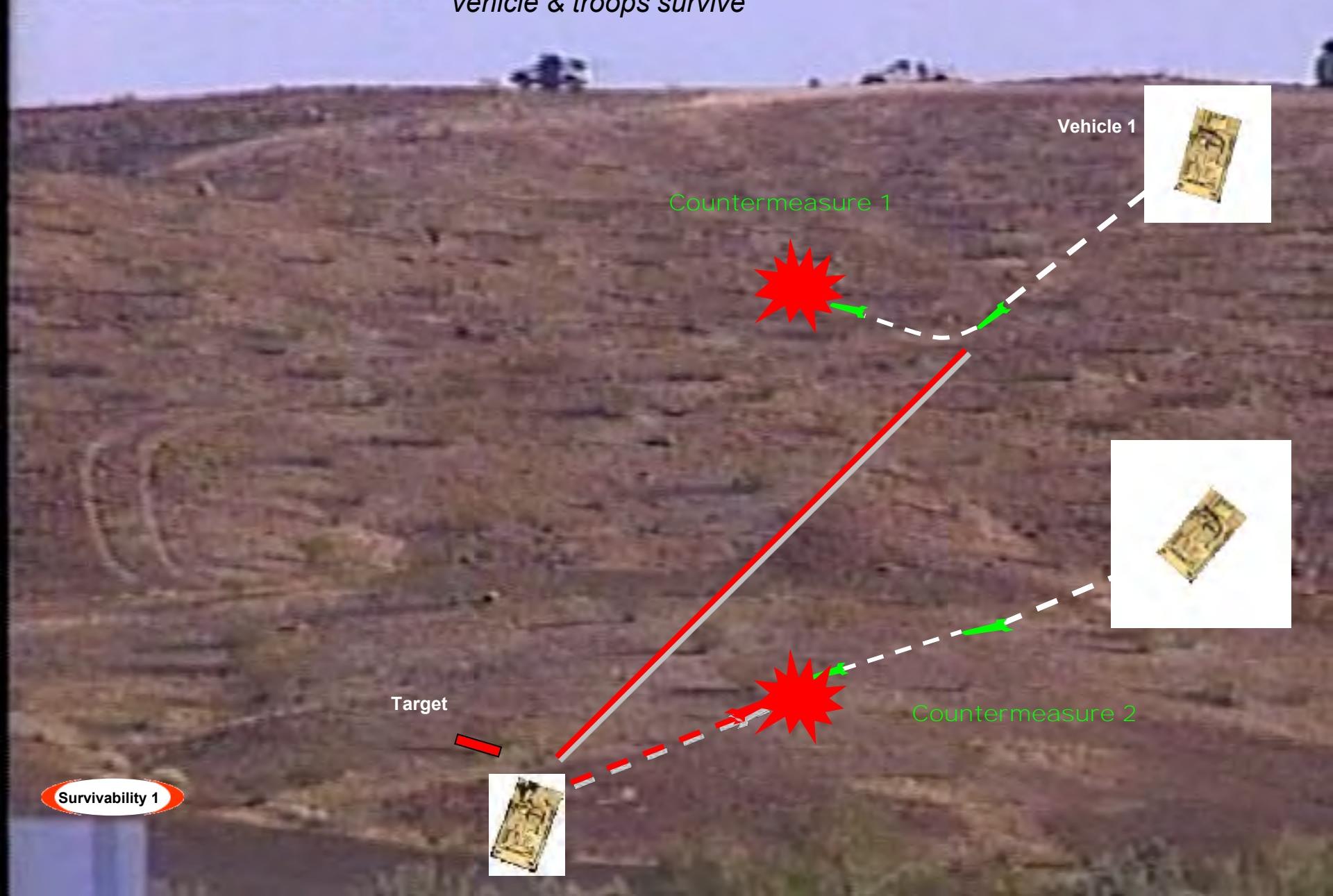
## Crew Protection Systems



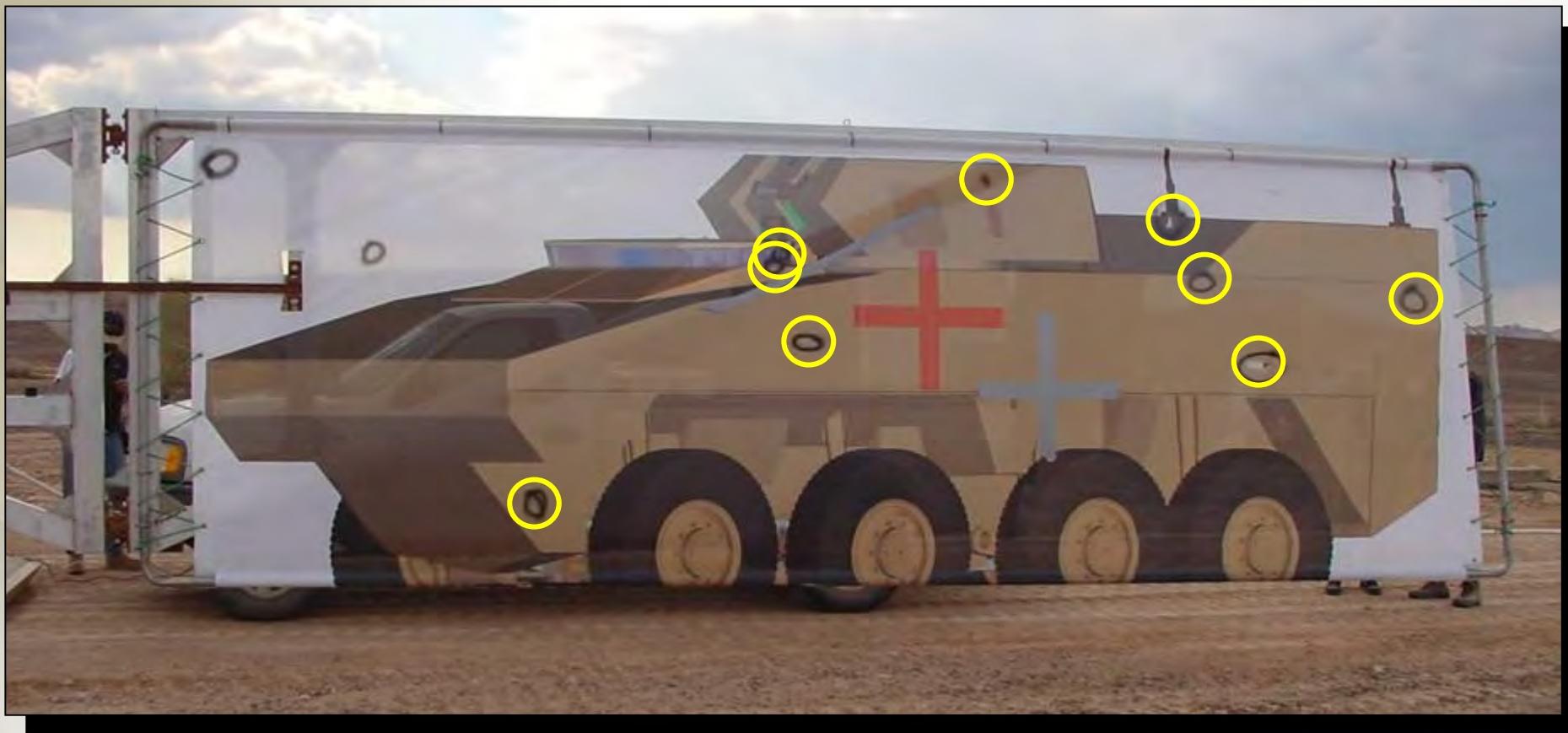


# Survivability Test Setup

*2 simultaneous threats - 2 countermeasures = 2 defeats  
vehicle & troops survive*



# Residual Hits on the Silhouette



# Tank Fired KE Defeat



Survivability 2

# Advanced Armors

Kill Enemy  
Before  
Detected

Local  
Situational  
Awareness

Don't Be  
Detected  
Don't Be  
Acquired

Signature  
Management

Don't Be  
Hit

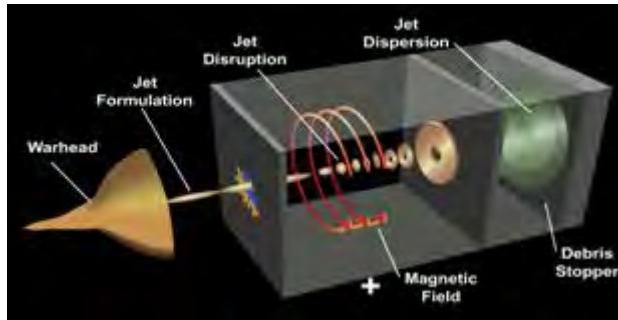
Electronic  
Warfare/Active  
Protection  
Systems

Don't Be  
Penetrated

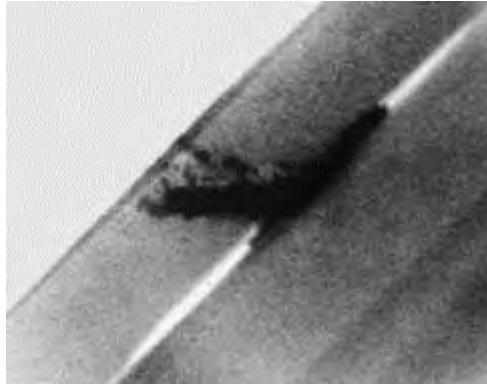
Advanced  
Armors

Survive  
the Hit

Crew  
Protection  
Systems



Electro-Magnetic Armor



Ceramic Armor



Advanced Composite  
Structural Armor

# Crew, Component, and Structure Survivability

Kill Enemy Before Detected

Local  
Situational Awareness

Don't Be Detected  
Don't Be Acquired

Signature Management

Don't Be Hit

Electronic  
Warfare/Active Protection Systems

Don't Be Penetrated

Advanced Armors

Survive the Hit

Crew Protection Systems



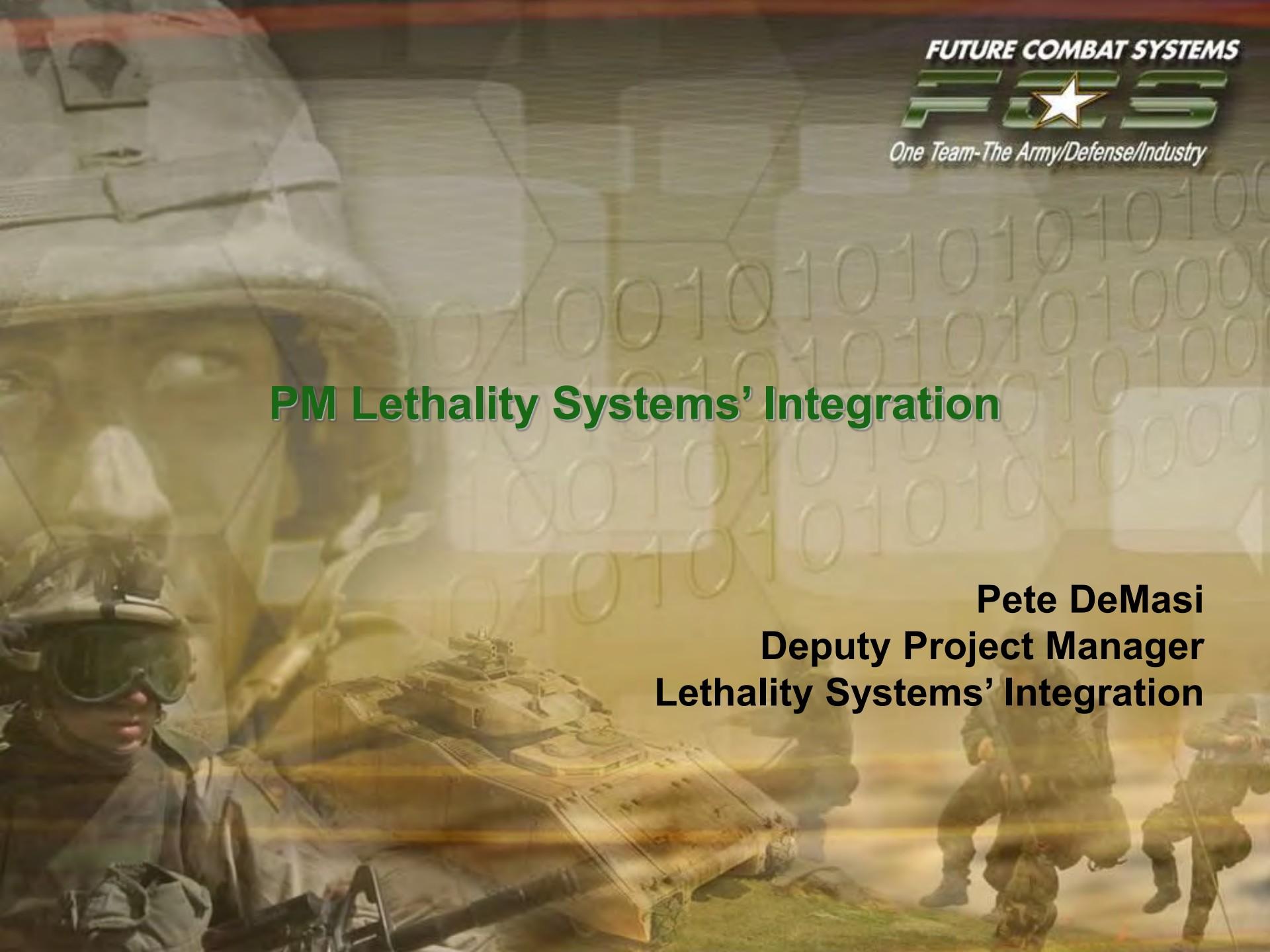
- Mine Protection
- Fire Protection
  - Ammunition (Completed in FY02)
  - Petroleum, Oil, Lubricants
  - Advanced mobility components
- Ballistic Shock
  - Structure, Substructure, Components

# Summary

## Critical Survivability Technologies

- Signature Management
- Hard and Soft Kill
- Armor
- Crew/Component Technologies

FCS manned ground combat vehicle  
survivable on the modern battlefield



**FUTURE COMBAT SYSTEMS**



*One Team-The Army/Defense/Industry*

## **PM Lethality Systems' Integration**

**Pete DeMasi**  
**Deputy Project Manager**  
**Lethality Systems' Integration**

# Purpose

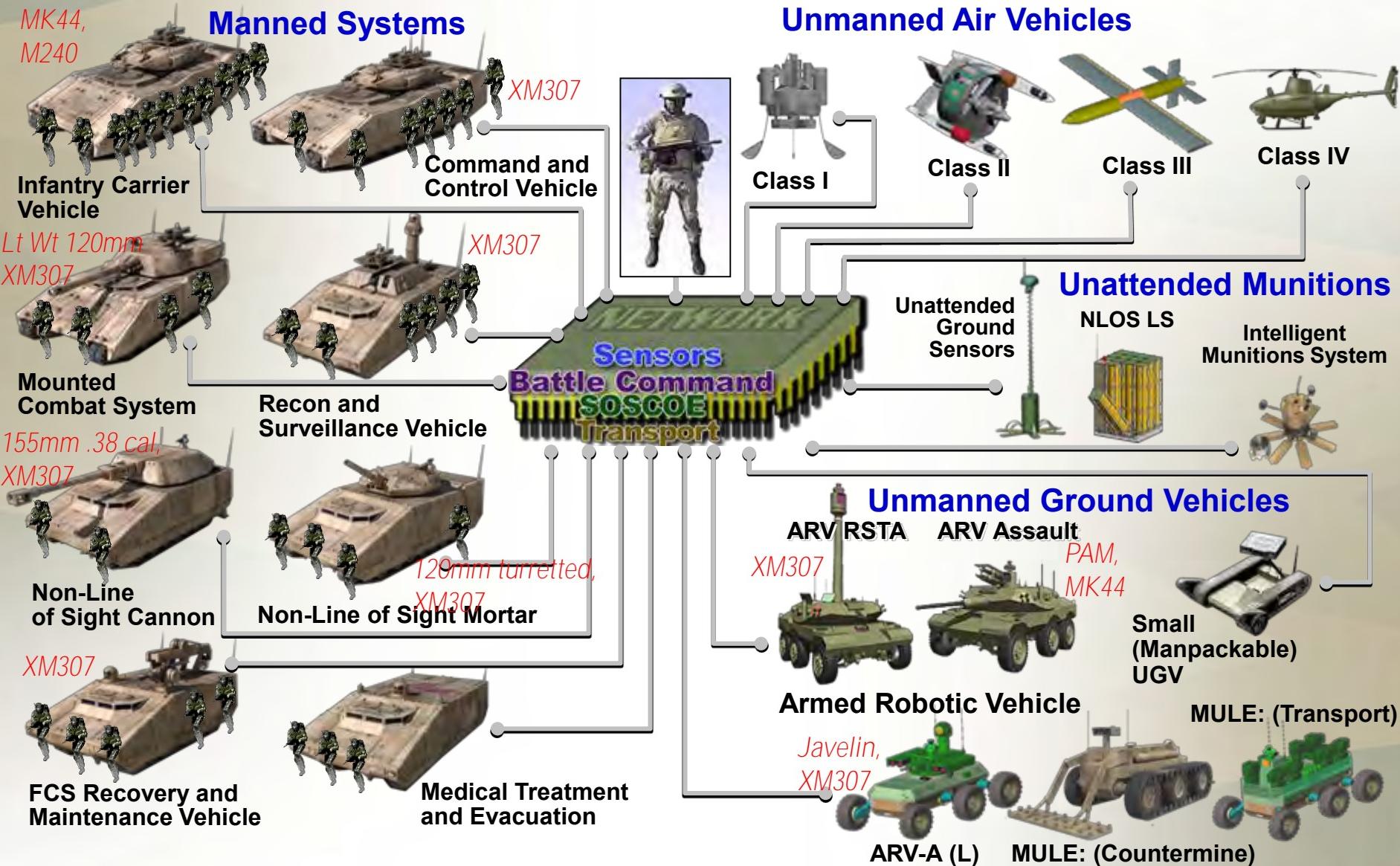


**To Present Lethal and Non-Lethal  
Opportunities to Industry**

# Agenda

- Key Decisions/Recommendations
- Potential Opportunities
  - NL Ammo
    - Non-Lethal Trade Results
  - 30mm Ammunition
  - 120mm Ammo
    - AKE
    - LOS-MP
    - MRM
  - 120mm Mortar Tube and Breech

# FCS Increment 1, Lethality Recommendations



# Key Lethality Decisions

## Non-Line of Sight Cannon (NLOS-C)



Excalibur



- 155mm, 38 Caliber Cannon
- Excalibur

## Non-Line of Sight Mortar (NLOS-M)



PGMM



- 120mm Turreted, Breech-loaded Mortar
- Precision Guided Mortar Munition (PGMM)

## Mounted Combat System (MCS)



MRM



- 120mm Caliber
- Mid-Range Munition (MRM)

## Infantry Fighting Vehicle (ICV)



- MK44 (30mm system, growth to 40mm)
- M240 7.62mm MG

## Common Close Support Weapon (CCSW)



- XM307 25mm (Defensive armament for C2V, RSV, MCS, NLOS-C, NLOS-M, FRMV, ARV(A)-L and ARV-RSTA)

# Non-Lethal Trade Background/Objectives



- Background
  - FCS ORD contains requirements for Non-Lethal Weapons (NLW) capabilities for FCS MGVs, UGVs and IMS
  - A study is on-going to determine how these ORD requirements can be met across FCS FoS
- Objectives
  - Determine the best NLW for the FCS FoS consistent with meeting the ORD requirements, integration, cost and risk
  - Determine a strategy for implementing these NLW on the FCS FoS
  - Develop a NLW roadmap including technology, integration, cost and schedule for implementing the strategy
  - Focus development of technology to feed NLW into the FCS FoS
  - Determine appropriate SoS Specs for each non-lethal ORD reqt

# FoS Non-Lethality Requirements



- The FCS FoS must be capable of Joint networked lethal and non-lethal effects that achieve overmatch – out of contact and in contact, at tactical standoff and in close combat.
- The FCS FoS must employ non-lethal effects in a complementary manner (lethal effects combined with non-lethal effects) to enhance combined-arms effectiveness across the spectrum of conflicts, day or night.
- Delivery means will include Soldier emplaced, LOS, BLOS, NLOS, and UMS.

# MGV Non-Lethality Requirements



- FCS Manned Systems (with the exception of MV-E & MV-T, ICV & R&SV) must conduct day/night and adverse weather engagements while stationary or on the move with a common close support weapon.
- Effects are scalable from lethal to **non-lethal**. This weapon system will be capable of firing multiple types of ammunition: anti-personnel, armor piercing, area effects, incendiary, **non-lethal**, and tracer from a common dual-fed magazine (selectable by the crew) with a selectable default setting.

# UGV Non-Lethality Requirements

The FCS ARV (all) must be able to employ modular non-lethal capabilities to:

- (1) confuse and deceive the enemy as to our intentions by obscuring our force and intentions, screening friendly force movements, and illuminating and exposing target areas hidden by darkness
- (2) flush out the enemy
- (3) deny people access to or movement through a particular area/point/facility
- (4) deny vehicles access to or movement through a particular area/point/facility.

The SUGV must be able to employ non-lethal projectiles, obscurants and distraction devices, malodorants, riot control agents, electricals and markers specific to the MOUT environment.

# Non-Lethal Trade Interim Results

FCS Vehicles	ORD Non-Lethal Requirement	SDD-168 Recommended Non-lethal Solution
All MGVs with CCSW	CCSW non-lethal munition	XM307 25mm non-lethal airburst munition
ARV-As, ARV-RSTAs	Capability to: (1) obscure own force, (2) illuminate the enemy, (3) flush out the enemy, (4) deny people access, (5) deny vehicle access	Modified LVOSS Launch System
ICVs and R&SVs	ORD implies a non-lethal munition for MK44	Modified LVOSS Launch System
IMS	Array of non-lethal capabilities	Non-lethal omni-directional munitions: flash bang, RCA, and blunt trauma
SUGVs	Non-lethal projectiles, obscurants and distraction devices	Two modules: (1) non-lethal munitions module, (2) strobe light distraction module
NLOS-Ms	Special fires that provide non-lethal effects	Non-lethal 120mm Mortar Munition
NLOS-Cs	NLOS non-lethal delivery means	Non-lethal 155mm Artillery Munition
ARV-As BLOS	BLOS non-lethal delivery means	Non-lethal BLOS Round

**Opportunities Exist for Non-Lethal Development in 25mm,  
LVOSS, 155mm Cannon and 120mm Mortar Systems**

# Advanced Crew Served Weapon System Description



## Defensive Armament for:

- C2V
- MCS
- FRMV
- NLOS-M
- NLOS-C
- ARV-RSTA
- ARV-A(L)

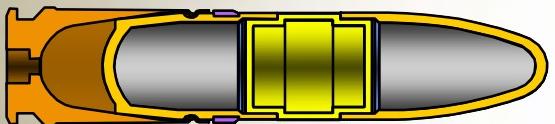
## Supports FCS Defensive Armaments

- ✓ Minimal Interior Space Claim
- ✓ Light Weight / Low Recoil  
Minimizes Mount Weight and Stabilization Requirements
- ✓ Dual Feed Capable
- ✓ Lethal 25mm Munitions
  - Air Burst Defeats Defilade Targets to 1,000m
  - Suppress and Defeat Area Targets to 2,000m
  - Armor Piercing Defeats Light Armor
- ✓ Muzzle Velocity Correction for Improved Accuracy
- ✓ Capable of Remote Operations
- ✓ Day/Night/All Weather Capable
- ✓ Fire on the Move Capable

**Grenade Launcher Performance in a Light Machine Gun Package!**

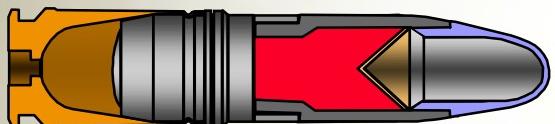
# Advanced Crew Served Weapon System Description (Cont'd.)

HEAB Cartridge



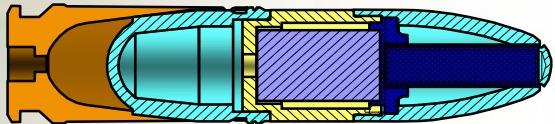
- HEAB Defeats Exposed and Defilade Targets
  - Precision Air-Bursting
  - Controlled Fragmentation Warhead

AP Cartridge



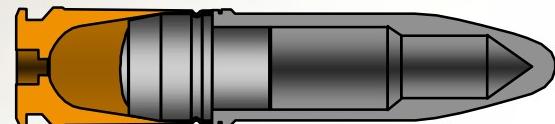
- AP Defeats Light Armor
  - Armor Piercing Shaped Charge Round

TP-S Cartridge



- TP-S Flash Bang Training

TP Cartridge



- TP Simple Two-Piece Projectile for Training

# Potential Joint Non-Lethal Options for UGV's



66mm Non-Lethal  
Munitions / Dischargers



*Existing Non-Lethal  
Capabilities w/ Conceptual  
Integration Locations on UGV*



Long Range Acoustic Device  
(Hailing & Warning)



*Applicable to Other Platforms*



FN303



M5, Modular  
Crowd Control  
Munition on  
VMS

# XM1063 Non-Lethal 155mm Projectile



# 30mm Ammunition Requirements



- **Anti-Material**
  - Defeat Threat LAVs (Light Armored Vehicle) with a single three round burst.
- **Anti-Personnel**
  - Defeat Individual and Groups of Threat Soldiers with a single three round burst per soldier ,
  - Group Targets include 2-man and 8 Man Squads.

# 30mm Gun and Ammunition Solutions



- 30mm Mk 44 Gun with AP (Armor Piercing) & AB (Air Burst) Rounds Meet FCS Requirements for Three Vehicles
  - Infantry Carrier Vehicle (ICV)
  - Armed Robotic Vehicle - Assault (ARV (A))
  - Recon & Surveillance Vehicle (RSV)
- Training Ammo for AP & AB Rounds also Required
- Marine Corps Qualified 30mm Rounds for EFV

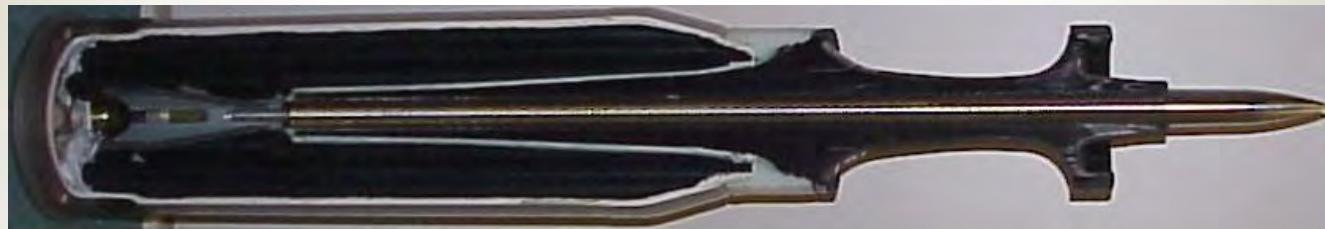
# 30mm Acquisition Approach

- **Qualify Marine Corps AP Rounds (FY04-FY06) to Meet FCS Anti-Material Requirements**
- Develop AB to Meet FCS Anti-Personnel Requirements (FY07–FY12)
  - Jointly Evaluate Industry Developed AB Round as a Possible Lower Cost NDI Alternative (FY05–FY06)
  - Pursue Best Solution
- **Qualify Marine Corp HE Trainer (FY04 - FY06) and NDI AP Trainer (FY09-FY12)**
- **Procure Beginning FY12:**
  - AP and AB Service Rounds
  - HE Trainer and AP Trainer

**Opportunities Exist for 30mm AB Development, NDI AP Trainer Qualification, and Production of All Tactical and Training Rounds**

# 120mm AKE Ammo

- Advanced Kinetic Energy (AKE)
  - There is a need for an MCS to be capable of firing unguided direct fire LOS munitions to defeat current and projected threat MBTs with Explosive Reactive Armor (ERA) and Active Protection Systems (APS)

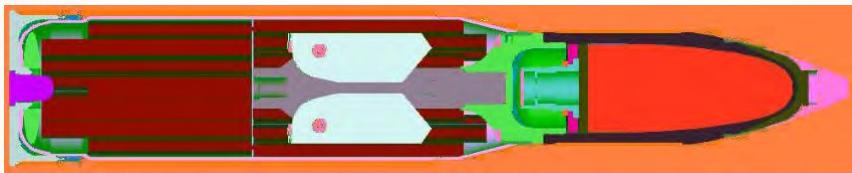


Opportunities Exist for Development (FY12- FY15) and Production (FY13-FY16) of an AKE 120mm Round

# 120mm LOS-MP Ammo

- **LOS (Line Of Sight) – MP (Multi-Purpose)**

- A moving or stationary MCS must be capable of firing munitions to defeat massed infantry or ATGM crews
- An MCS must fire munitions capable of breaching a 30" x 50" hole in bunkers and reinforced concrete walls



Opportunities Exist for Development (FY12- FY15) and Production (FY13-FY16) of an AKE 120mm Round

## 120mm Ammo

- Mid-Range Munition (MRM)
  - An moving MCS must be capable of firing guided Beyond Line-of-Sight (BLOS) munitions.
  - Draft RFP planned for FY07.



**Opportunities Exist for Development (FY08- FY13) and Production (FY11-FY23) of a MRM 120mm Round**

# NLOS-Lethality Requirements

- FCS NLOS Mortar must be capable of LOS engagements for self-defense to destroy moving or stationary light armored vehicles.
- FCS NLOS Mortar must be capable of firing a 6 round Multiple Round Simultaneous Impact (MRSI) mission.
- FCS NLOS Mortar must be able to engage targets at ranges out to 8 to 12km.
- FCS NLOS Mortar must be capable of firing developmental munitions.

# 120mm Mortar Description

- Tube and Breech
  - NLOS-M cannon and breech subsystem
    - Fires current smoothbore/development
  - 120mm Mortar Ammunition/Propellant
    - Three meter tube (8 KM range)
    - Integrated with In Bore Air Regulation (IBAR) design
    - Automatic ammo handling system
    - Projectile retention system (low angle fire)
    - Breech automatic cooling system (high RoF)

# 120mm Mortar Acquisition Approach

- FCS is procuring goods and services related to the engineering development of the NLOS-M Tube and Breech (**Best Value Assessment**):
  - Engineering Development of Tube and Breech Assembly Integrated w/ ASD IBAR Sub-System
  - Test and CMP support
  - 4 Prototypes (Firing Platform, MEITS, & 2 Vehicles)
- We are not procuring:
  - Gun Drives
  - Gun Mounts
  - Recoil Mechanisms
- *These are common components with the NLOS-C.*
- RFP release in Nov 2005

Opportunities Exist for 120mm Mortar Tube and Breech

# 120mm Mortar Ammunition

## Family of Extended Range Ammunition (FERA)



- The XM984 is a 120mm extended range mortar cartridge that provides extended range through the application of lightweight composite structural elements and post launch rocket motor impulse.
- PGMM Increment II currently has a requirement for extended range that would benefit from the application of lighter airframe components, rocket motor impulse and airframe shaping developed during the XM984 STO.
- PGMM Increment II can immediately leverage XM984 as a proven design.
- Range requirement for PGMM Increment II can be met through minor airframe drag reduction and higher impulse aluminized rocket motor.

Opportunities Exist for 120mm Extended Range Ammo

# Summary

- Key Decisions/Recommendations
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  - NL Ammo
    - Non-Lethal Trade Results
  - 30mm Ammunition
  - 120mm Ammo
    - AKE
    - LOS-MP
    - MRM
  - 120mm Mortar Tube and Breech



**FUTURE COMBAT SYSTEMS**



*One Team-The Army/Defense/Industry*

## Propulsion

**Dean Vanderstelt  
Director, Project Engineering  
GDLS**

# Many Capabilities Demand Greater Electrical Power

Fire Control System & Turret Drives

NBC / ECS Systems

Electrically Enhanced Armors

Crew Displays and Controls

Active Protection Systems

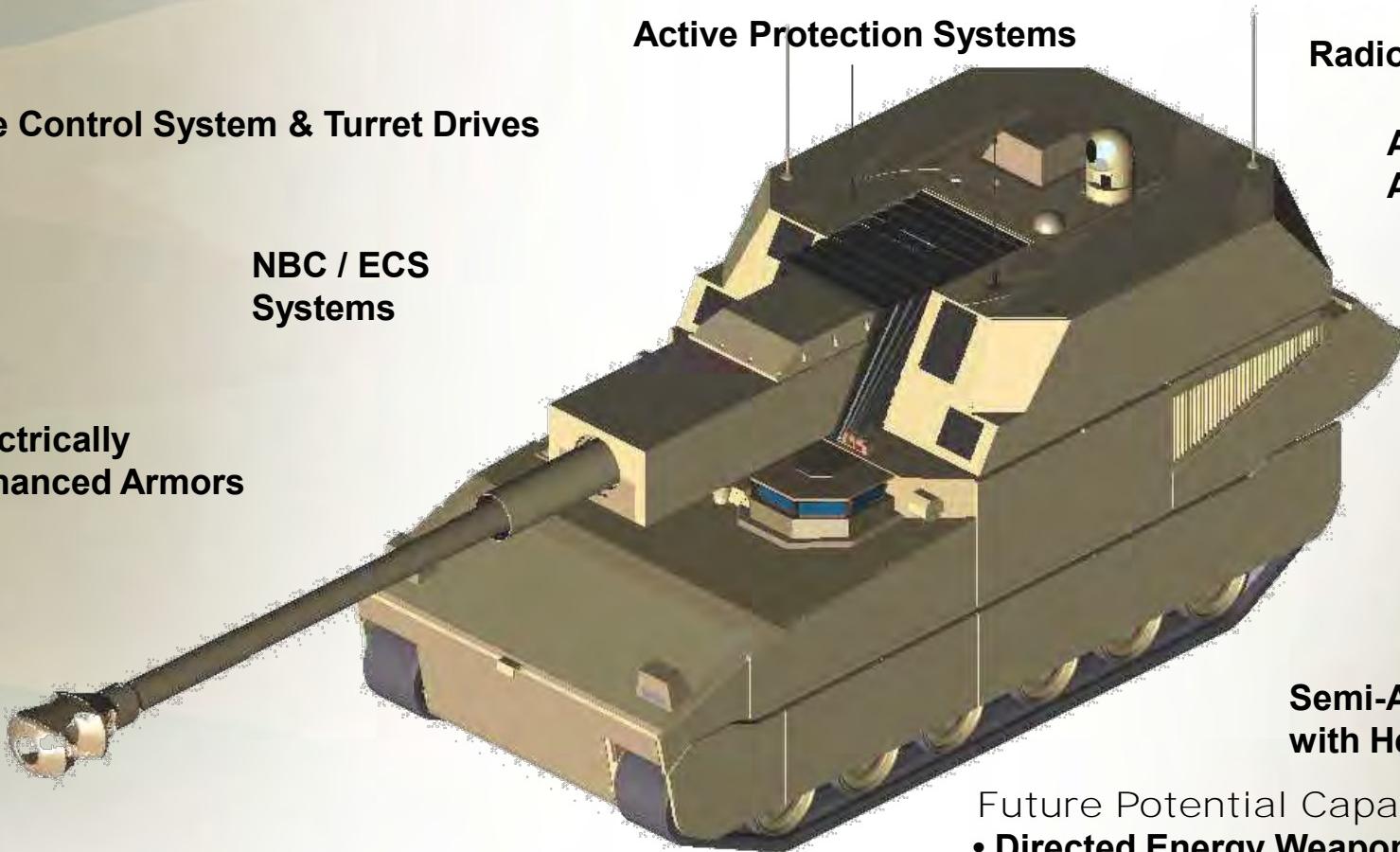
Radios & Sensors

Autoloader & Ammo Handling

Cooling Fan

Active Track Tensioner

Semi-Active Suspension with Height Control

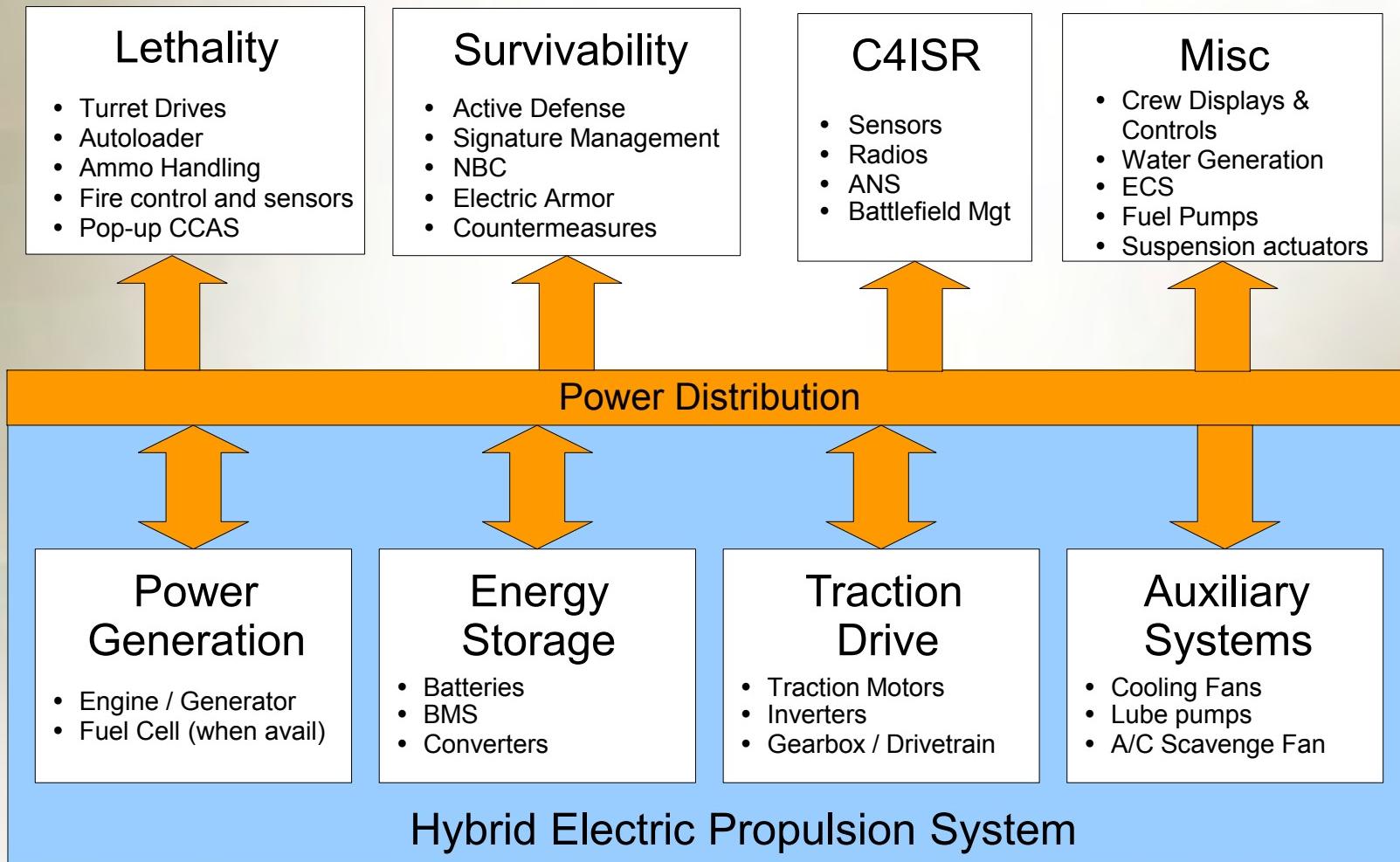


## Future Potential Capabilities

- Directed Energy Weapons
- Missile Loading and Launching
- More Advanced Electronic Warfare Systems
- EM Rail/Coil Gun
- Extended Duration Engine Off Silent Watch

A Robust Power & Energy Architecture is required to enable an all-electric vehicle with intelligent power management for greater mission effectiveness

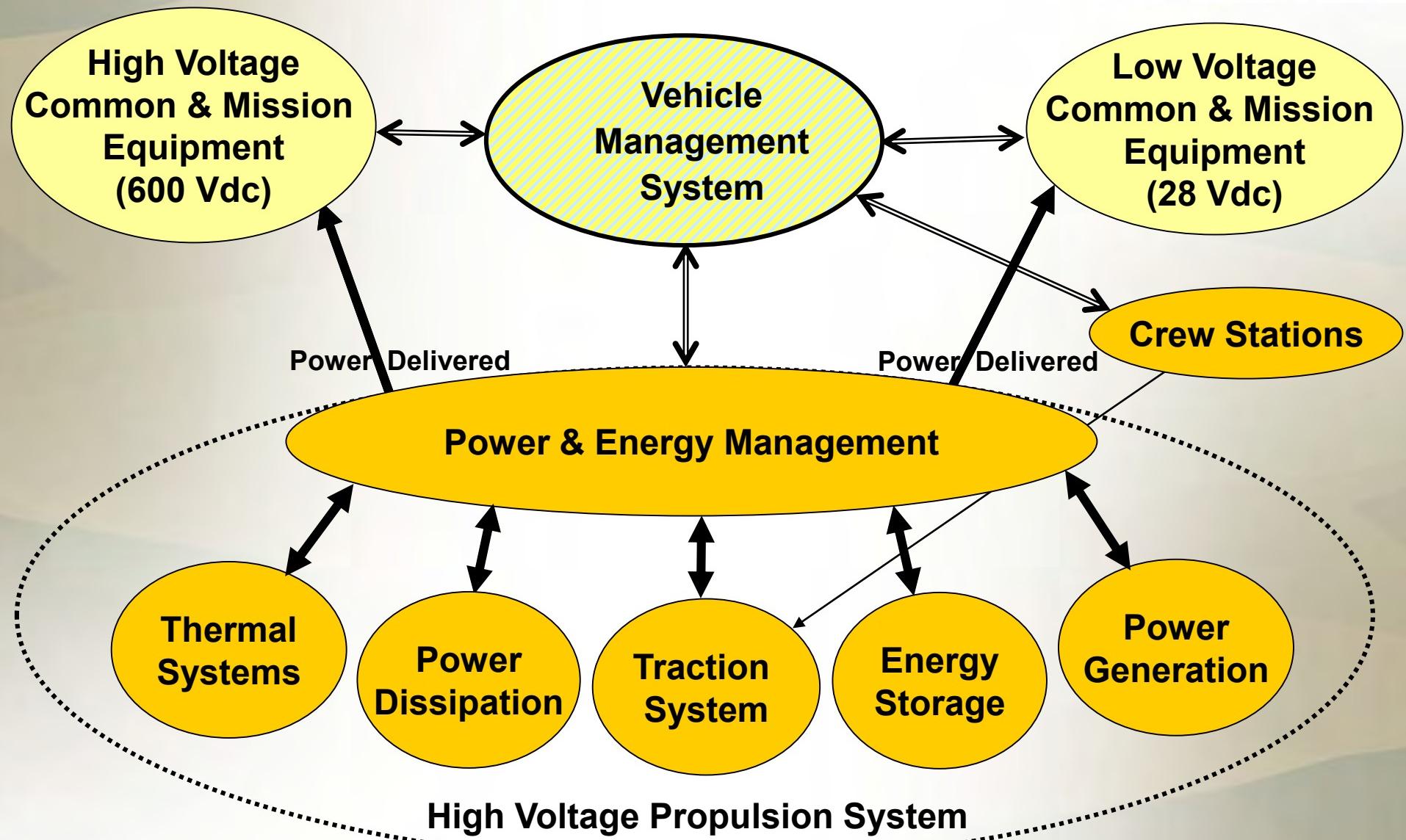
# Smart Hybrid Electric Architecture Provides Power for All



# System Architecture Tenets

- Develop a dynamically responsive system architecture for Manned Ground Vehicles that stresses the following:
  - Smaller Weight and Space/Volume than Current Force Vehicles
  - Commonality
  - Maximize software reuse / achieve resource optimization
    - Reduce hardware duplication among subsystems
  - Graceful System Degradation (Survivability/Reliability)
    - System/Subsystem Redundancy
  - Flexible and Adaptable Architecture
    - Implementation of Standard and Open Architecture Interfaces
  - Improved Performance

# MGV Power & Energy Management Architecture

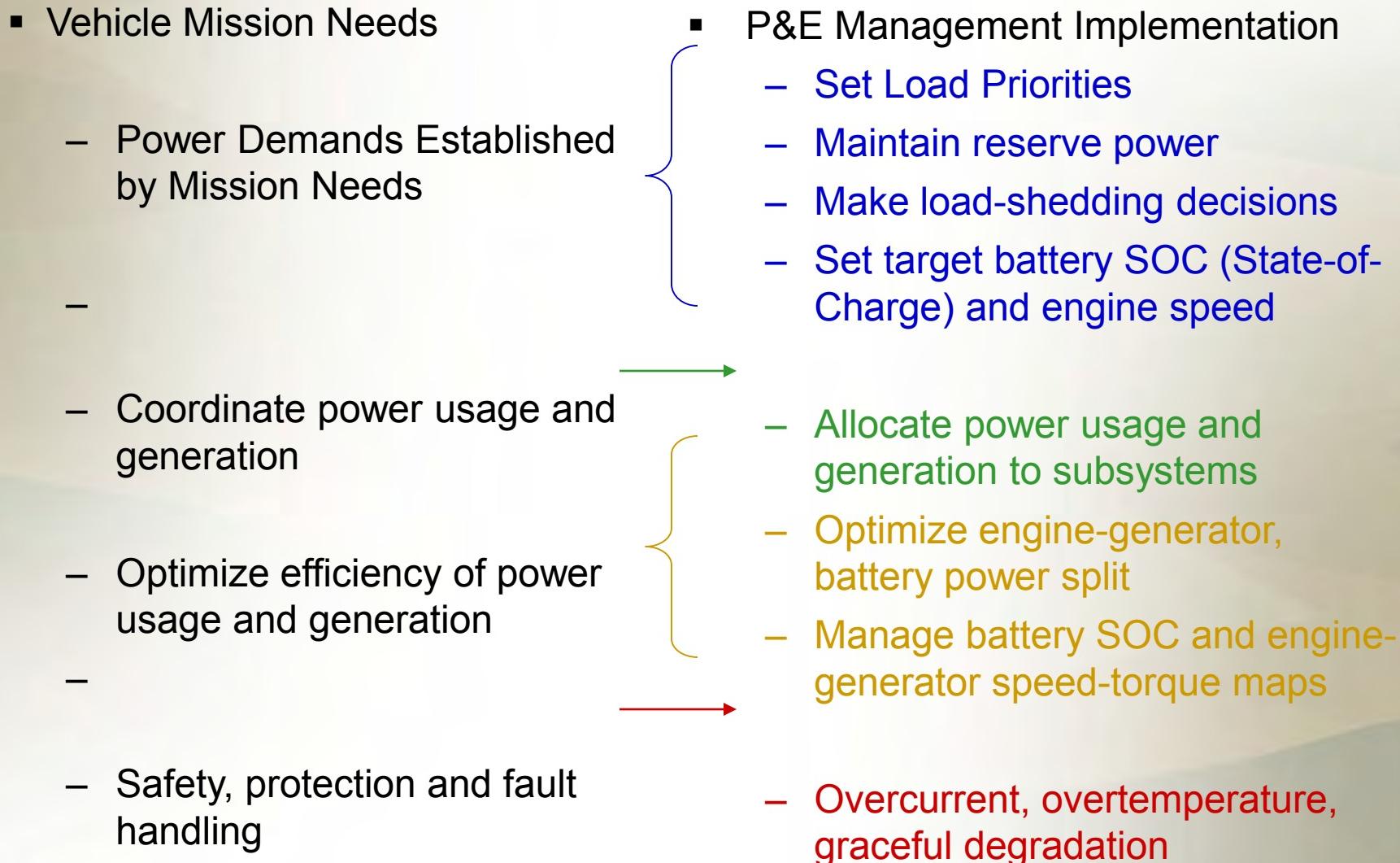


# MGV Power and Energy Management Examples

- Examples of applied power and energy management:
  - Load prioritization and shedding directed through established protocol with Vehicle Management System
  - Battery power and cooling fan modulation during acceleration to minimize Power Generation and Thermal Management system size
  - Automatic Override of Component Protection Algorithms in Critical Combat Mode (Max Power even though Component temps are high)
  - Instantaneous power output plus power reserve will be managed to maximize responsiveness to changing loads (mode dependent)
  - Stored energy will be managed to maximize transient power needs (such as vehicle dash/survivability move) and braking energy recovery to improve fuel economy and minimize cooling loads

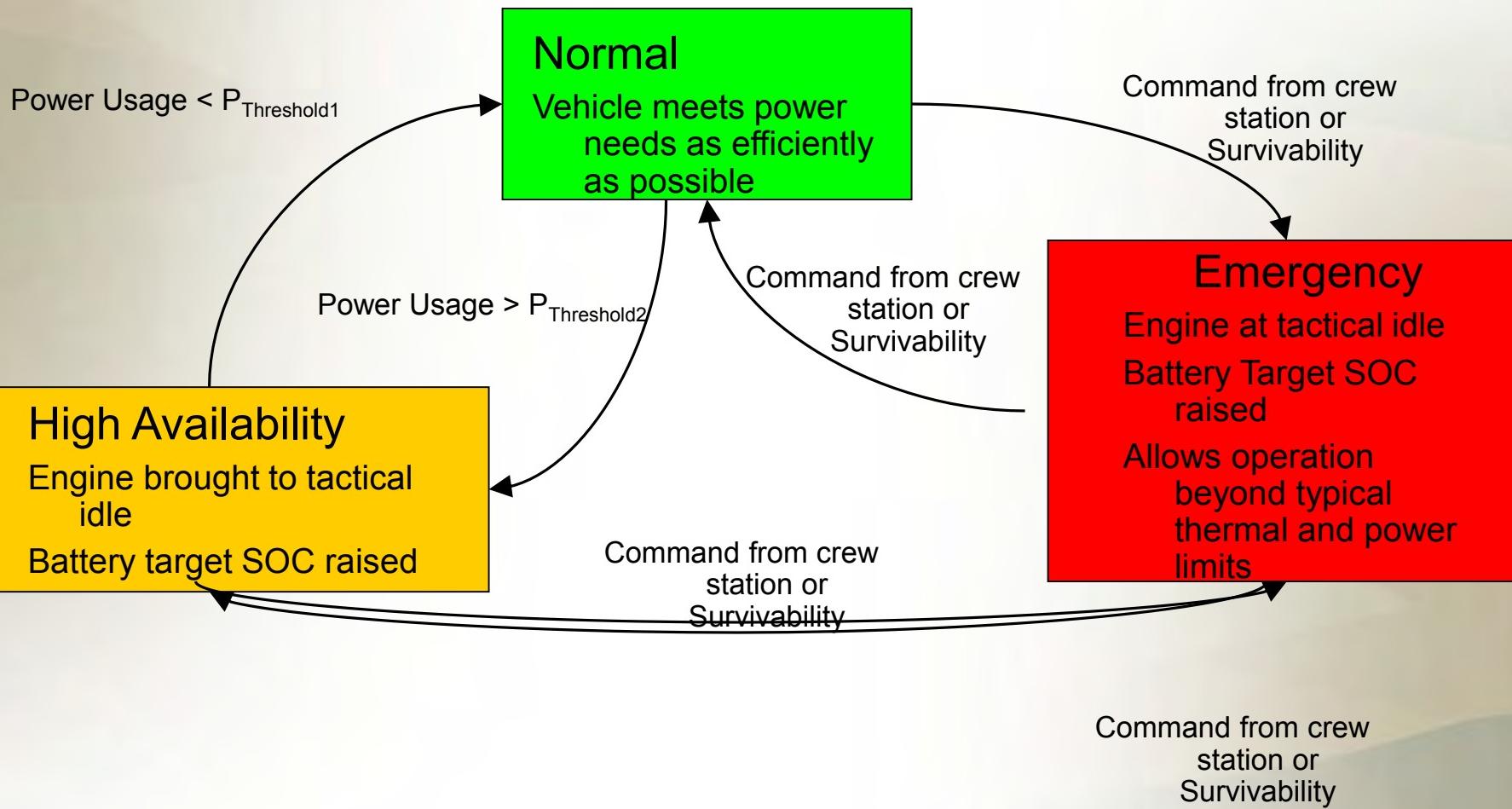
# Mapping Mission Needs to Power and Energy Management

## Mapping Vehicle Mission Needs to P&E Management Implementation



# Notional Power and Energy Management Modes Example

- Within Vehicle's Normal Operation/Combat mode
  - Power and Energy Management has three basic modes

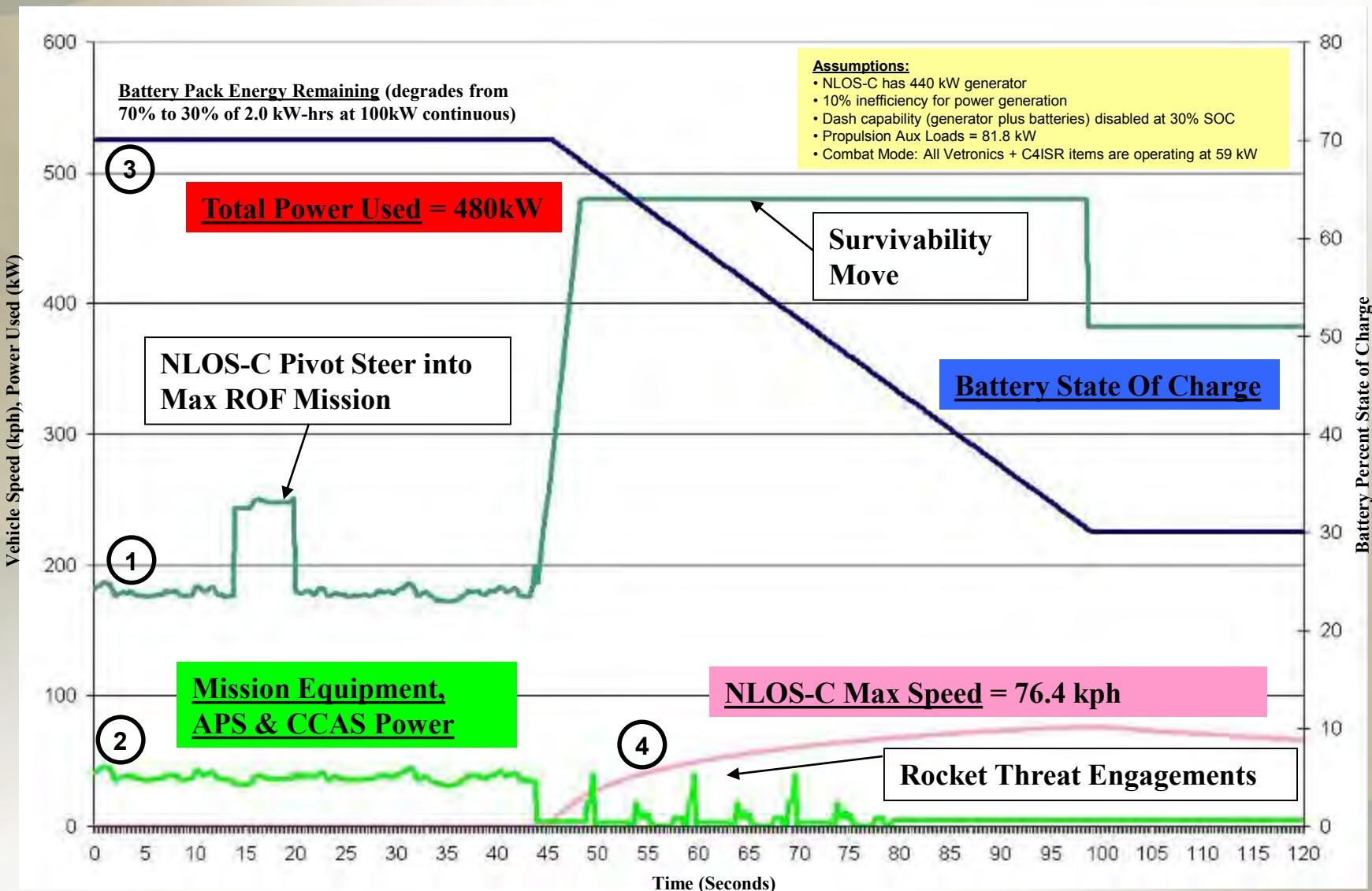


# Stressing Power Analysis Goals based on Mission Needs



- Develop a set of stressing power curves for each MGV Vehicle based on Vehicle Integrator generated [Design Reference Mission Profiles \(DRMP\)](#)
- Define the worst case scenarios and determine what it takes to satisfy the Requirements in terms of -
  - Power Generation and Energy Storage system rating (size)
  - Cooling System capability and size
  - Define the limits of up-powering to meet the mission profiles within the air transport envelope
- Determine if loading from Vehicle Mission events can be accommodated within acceptable degradation limits
  - Mission degradation will be assessed based on the ability to provide power based on the following priorities:
  - Survivability -> Communications -> Lethality (Or Unique Mission Need) -> Mobility -> Remaining loads
- Identification of acceptable power allocation and load shedding solutions for the highest total load scenarios to minimize overloading

# MGV Stressing Power Scenario Example



# Summary

- Mission equipment loads now represent a significant portion of the overall power loads for MGVs. → It's NOT just about Propulsion loads anymore!
- Transient power demands will be met by energy storage in order to reduce installed engine power, system volume and weight
- Addressing mobility demands, as well as other platform and mission demands, must be managed interactively to balance and prioritize all loads based on system and user defined priorities.
- Intelligent control of power sources relative to major loads maximizes mission effectiveness with minimum installed power
- MGV Power and Energy Management Architecture:
  - Modular, Robust
  - Flexibility - can implement wide range of techniques and strategies
  - Uses databus communication interfaces for real-time control
  - Accommodates future growth and development of both hardware and software

The FCS UA MGV Power and Energy Architecture is the Core Combat Vehicle Power and Energy Design that meets the Army's needs for the 21st Century

**Dean M. Vanderstelt  
Director, Project Engineering**

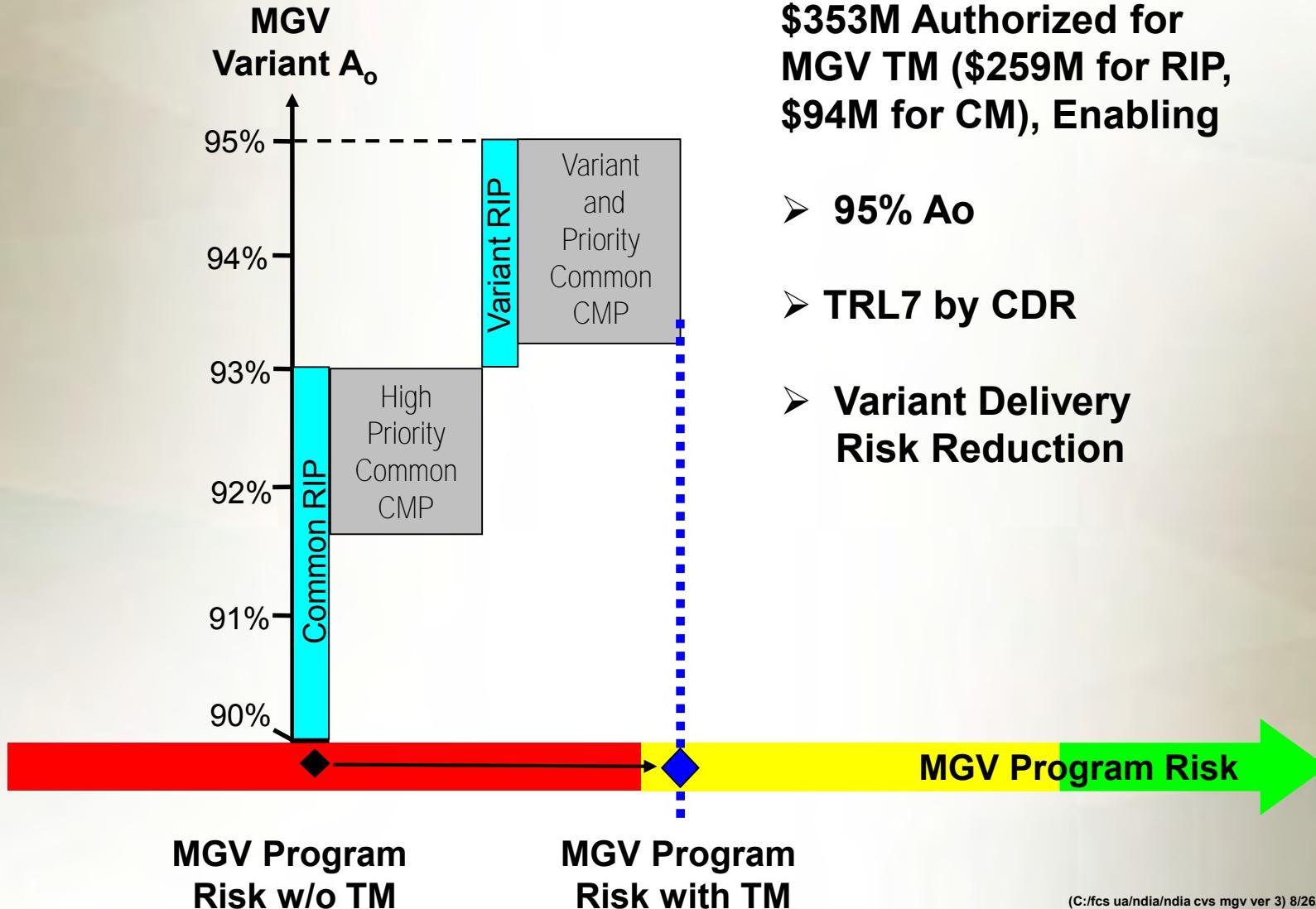
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# **MGV Technology Maturation/Reliability Availability and Maintainability (RAM) Overview**

**Tom Hartigan  
PM UA, MGV RAM-T Engineer**

# MGV Program Risk Assessment – Case For Tech Maturation (TM)

**TM = Component Maturation Program (CMP) and Reliability Investment Program (RIP)**



# Component Maturation Projects

- Band Track Survivability, Performance, Durability and Sustainability
- Mine Resistant Structures
- Add-on Armor Recipes and Integration Approach
- Hi-Power Li-Ion Platform Energy Approach
- Generator/Inverter Power Stage Reliability
- Traction Drive Maturation
- Short Range Counter Measure Common Radar Integration
- Multimedia Slip Ring
- Rooftop Deconfliction/Integration (C2V and RSV)
- MCS Firing Test Rig
- MCS Ammunition Handling System (AHS)
- MCS High Voltage Electric Drives
- MCS Automated Fire Inhibit System (AFIS)
- MCS Dynamic Muzzle Reference Sensor System
- MCS Ammunition Data Link (ADL)
- MCS Ammunition Sympathetic Detonation
- FRMV Towing Capacity
- FRMV Tactical Crane System
- NLOS-M In-Bore Round Retention
- NLOS-M Propellant Storage and Handling
- MV MC4 Software

# MGV Common Suspension Component Maturation Project

## Title: Track Survivability, Performance, Durability, and Sustainability

### Maturation Effort Description:

Conduct engineering and maintenance studies/demonstrations to develop improved track compositions which will ensure increased survivability, mobility, sustainability and operational availability ( $A_0$ ).

### Consequence Of Not Funding Maturation Effort:

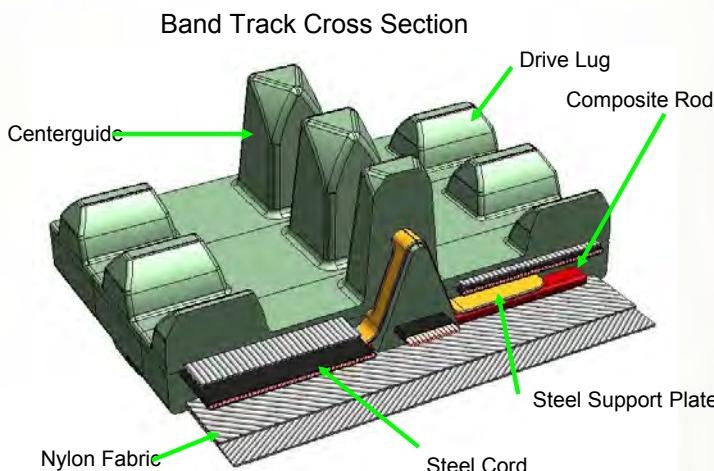
Current reduced durability causes degraded mobility performance, operational availability ( $A_0$ ), and increases the logistics burden. Without enhanced mine blast resistance crew survivability will be diminished. Lack of track segmentation leads to increased utilization of the Combat Repair Team (CRT) which increases the Logistics burden.

### Rationale:

- Enhanced durability is needed to meet FCS-MGV requirements and will reduce the track Life Cycle Cost.
- Increased mine blast resistance is needed to meet FCS – MGV requirements
- Increased mobility is required for FRMV.
- Track segmentation is required to meet reduced Logistical burden through less frequent use of the Combat Repair Team.

### Performance Improvement:

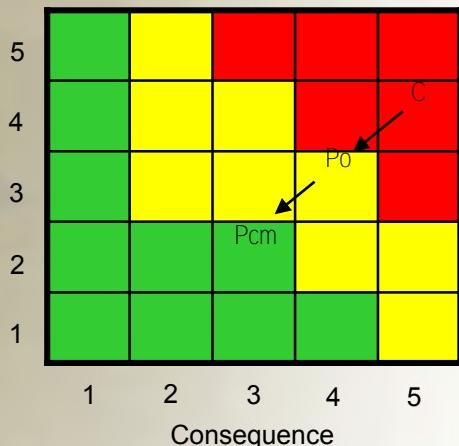
- In terms of mileage, the plan establishes a 2000 – 3000 mile goal for the track vs. the 400-500 miles demonstrated during the CTD phase on 22 ton platform.
- Reduce the installation time for the track by segmentation. This also reduces the equipment needed for installation. Installation time should be reduced to below 30 minutes.
- A 25-50% improvement in mine blast resistance compared to the CTD phase track.



# MGV Common Suspension Component Maturation Project

## Title: Track Survivability, Performance, Durability, and Sustainability

Risks: MGV 323 – Band Track

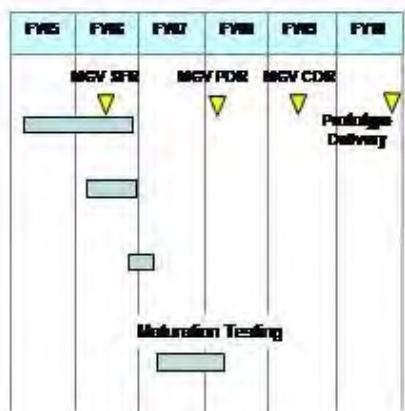


### Driving Requirements:

- 3.1.2.2.13.1.0-5 Mine Blast AT mine
- 3.1.2.2.1.3.4.0-1 & 0-2 Mine Blast AP mine
- 3.1.17.1.8.0-7 & 0-8 Wear Replacement

### Mitigation Steps and Schedule:

1. Design, analyze, simulate, and select survivable, durable, sustainable segmented track configurations.
2. Develop processes / tooling for high quality manufacturing.
3. Manufacture prototypes for tests: mine blast / KE, mobility/ traction, durability, joint tests, and sustainability demonstrations
4. Maturation T&E: survivability, performance, durability, mobility, sustainability tests & demonstrations.



### Contingency Plan:

- Failure to successfully mitigate this risk will:
  - Cause there to be inadequate survivability in the band track
  - Not address the current maintenance issues raised by the RAM team
  - Not incorporate necessary improvements needed to increase durability, survivability and maintainability.
- Fallback is to
  - Accept current survivability and maintenance of existing band track configuration or
  - Use heavier weight metallic track, but be faced with needing to accept the system weight impact and reduced mission capability

Total Approved Funding Allocation = \$10.5M

Funding Allocation By FY (\$M):

FY05 FY06 FY07 FY08 FY09

0.71 2.41 6.66 0.72 0

Related Gov't Work: TARDEC program to develop segmented rubber track.

# FCS Sustainment/Reliability



**The FCS Family of Systems (FoS) is required to have a reduction in maintenance and supply functions and a reduced logistics' burden for the Unit of Action (UA)**

- Rationale:
  - FCS-equipped Unit of Action characteristics of tactical dispersion and rapid offensive maneuver over tactical and operational distances demand superior FCS FoS reliability, availability, and maintainability (RAM) and reduced external resupply of the UA.
  - Cornerstone enabling capabilities include increased operational availability [measured by mission defined critical systems, greater than 85% (Ao) threshold, 99% (Ao) objective], reduced maintenance ratios [less than 0.10 threshold, 0.025 objective] maintenance man hours to operating hours (MMH/OH) and an objective of reduced fuel consumption, and on-board water generation.
  - Supporting enablers include component commonality, embedded diagnostic and prognostic systems, and rapid component replacement.

**The FCS program will exceed RAM-T thresholds**

# FCS Calls for Quantum RAM Improvements

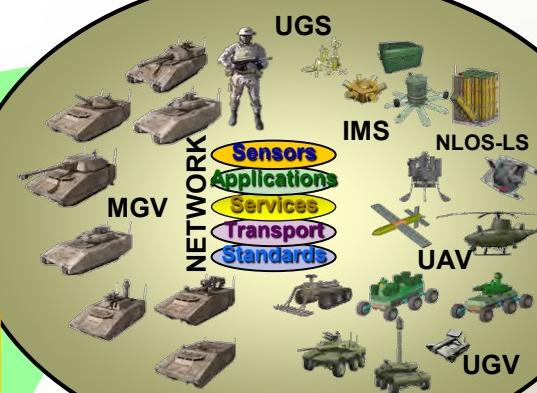
Lessons Learned

MGV Reliability Performance (MTBSA) Will Be 2 to 8 Times Better Than Previous Platforms Examined

Key Enablers:  
The RAM-T Case Approach  
Physics of Failure (PoF)  
Reliability Enhancement Testing (RET)  
Prognostics  
Probabilistic Design Analysis  
Integrated Design Process for Maint.

Early Design Influence

MGV MR Performance Will Be 2 to 4 Times Better Than Previous Platforms Examined.



*Early Program Resource Commitment is the Key!*

# FCS Contracting Approach to RAM-T

- The RAM-T Case Plan and Report contains the evidence to establish confidence in achieving the stated R/M requirements.
- Evidence that the three objectives have been met from all suppliers
  - Understanding the Requirements
  - Planning & Implementing a Program of Activities to Satisfy the Requirements
  - Assurances that the Requirements are being/have been met – Progressive Assurance
- RAM-T CASE Management Plan and RAM-T CASE Report
  - Key Supplier Deliverables
  - Case Report submission varies by supplier
  - Regular discussions through RAM Meetings/TIMs

**RAM-T CASE PLAN specifies a number of tools and methodologies to use and rationale as whether they will or will not be used.**

- Some of the techniques called out in the SDRL:
- Dynamic/static design modeling, simulation, or probabilistic analysis
- RAM-T Modeling, Optimization and Component/System Testing
- Environmental stress (operate and storage)
- Physics-of-Failure (PoF)
- Structural finite-element stress analysis
- Fatigue analysis
- Wear-out/service life analysis
- Prognostics analysis
- Fault detection/isolation analysis
- Availability Analysis
- Reliability Enhancement Testing (RET)
- Pit Stop Engineering
- Software Reliability

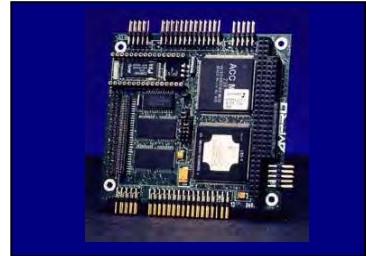
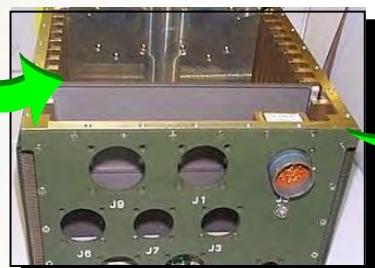
# Physics of Failure (PoF)

## Physics of Failure

- Early Design Influence through Physics-based Modeling of Critical Component Designs
  - Model the root causes of Failure
- Probabilistic approach to Modeling - Address Uncertainty
  - Allows for Design Optimization
- Modeling builds up to a Vehicle-Level Dynamic Simulation.
- Feeds directly into a Virtual Development Approach
- Robust Failure Models & CAD Tools

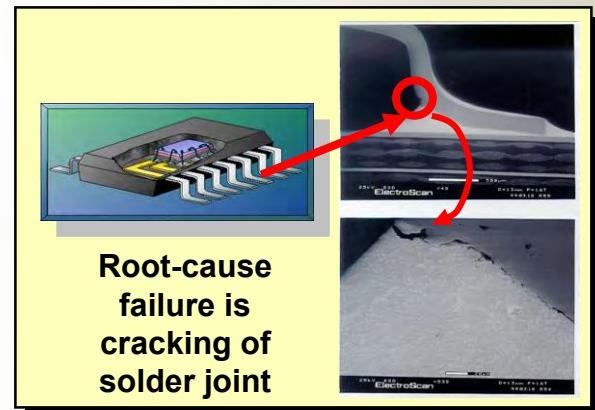


Stress (e.g., vibration) is propagated from system level to failure site



## Benefits

- Increased Fielded Reliability
- Reduced Log Footprint
- Reduced Maintenance Ratio
- Improved Prognostics
- Decreased O&S costs



Key Contributor to Increased Ao

- Reliability Enhancement Testing
- RET = Accelerated Life Testing (ALT); Highly Accelerated Life Testing (HALT); Highly Accelerated Stress Screening (HASS) - component/subsystem testing in highly accelerated environments to shake out additional failure modes
- Destructive test which incrementally increases environmental stresses to determine Failure Modes - Find Design Faults
- Test, fail, and corrective action prior to prototype integration, to prevent possible field failures
- Not a compliance test, and is not limited by component or product specifications
- Applied at multiple levels - Components, LRU, Subsystems

## Benefits

Rapid design and process maturation

Higher MTBF

Reduced total engineering time and cost

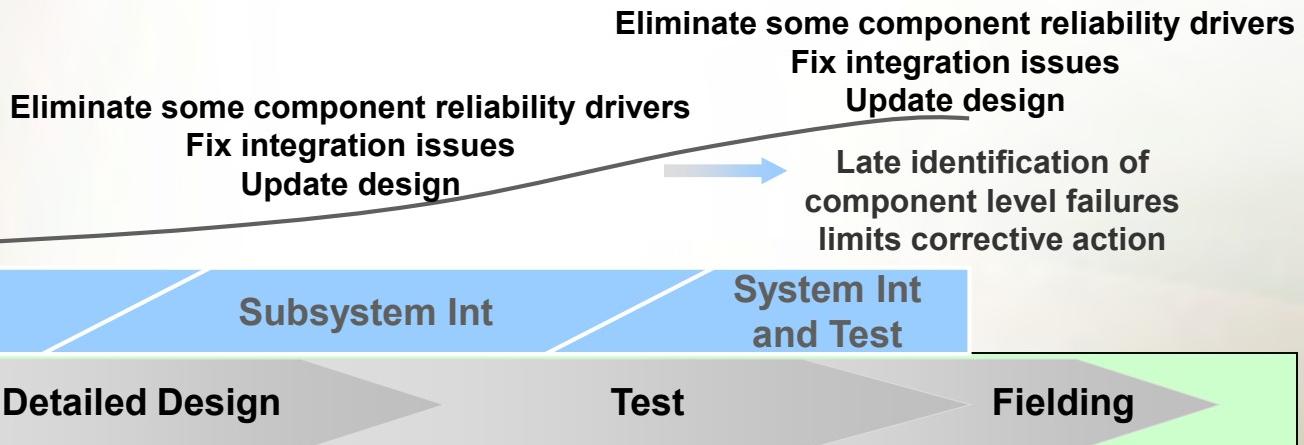
Minimize costly failures during system testing

Greatly reduced manufacturing screening costs

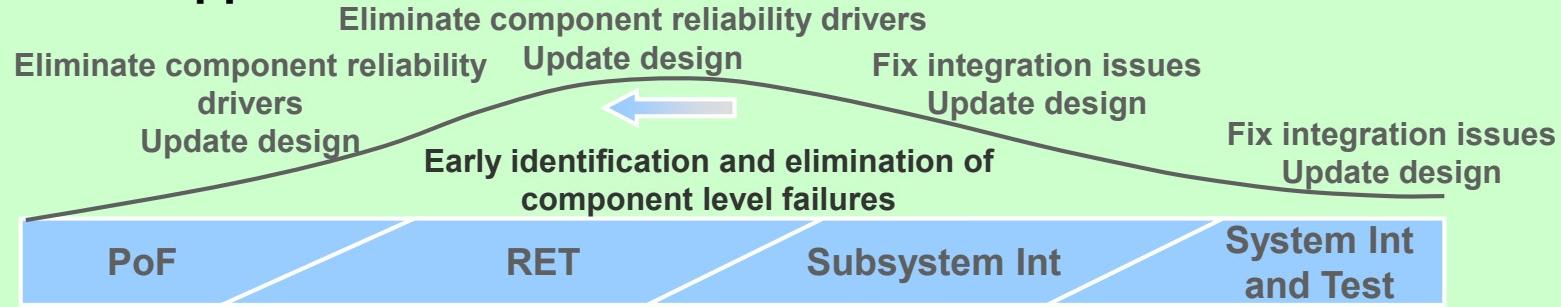
Reduced production and warranty costs

# The New RAM Design Paradigm

## Legacy Approach



## MGV Approach



**Emphasize: Early identification and elimination of failure modes**  
**Achieve: Higher Initial Reliability (Mi) on prototype delivery**

# Reliability Investment Plan (RIP)

- Background

- Baseline Contract - Dec 2003 based on MTBSA of 350-500 hours per variant, excluding GFE/CFE
  - Constrained by schedule and budget
  - Estimated platform Ao of 86-90%
  - Increased Log Footprint burden on UA
  - Unacceptable to User
- When FCS Transition came about the TRB saw a need for increased reliability investment
  - A Wedge of Money was fenced for Technology Maturation (TM)
    - TM = Component Maturation + Reliability Investment Plan (RIP)
  - MGV Reliability Investment Review Board of Govt/LSI SMEs evaluated VI RIP and provided recommendations to TRB for Approval
  - Program Approved \$208M for RIP from FY05 to FY12

**RIP Investment supports achievement of 95% Ao for MGV  
 And enormous LCC savings for the Army (~\$21B)**

# RIP Analysis Approach

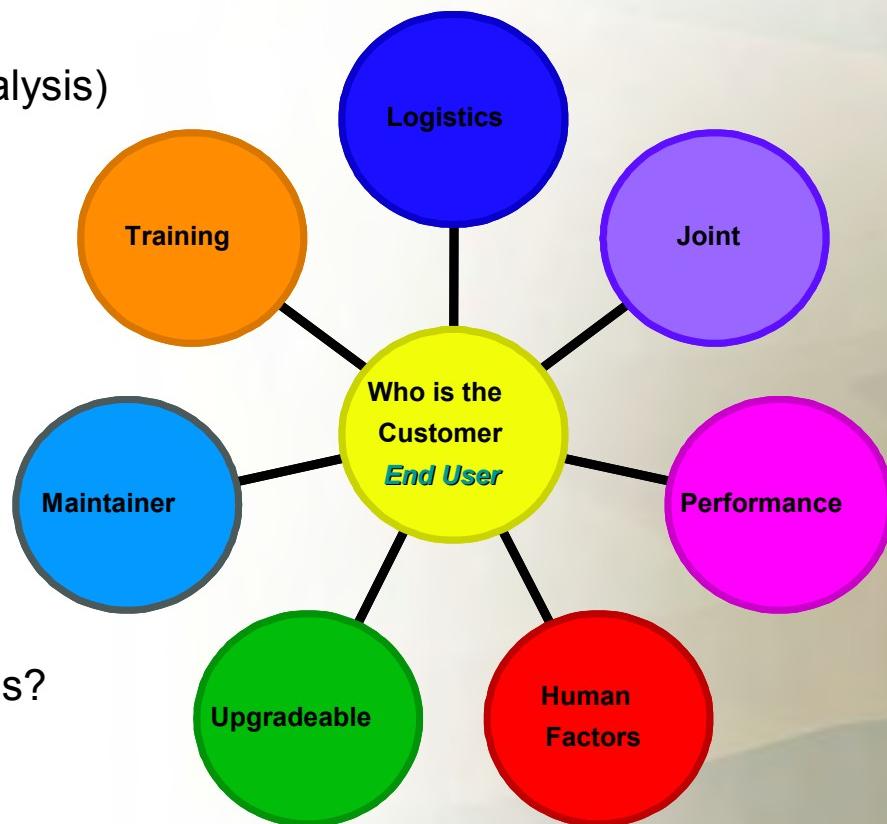
- Focused on Failure Mode Mitigation Prior to Integration Test
  - PoF- Physics-based modeling and simulation on all critical components and components which drive essential functions and log burden, to include FEA, fatigue, thermal, shock, vibrational analysis, dynamic modeling
  - RET - Reliability Enhancement Testing is conducted at component, LRU and subsystem levels to drive out additional failure modes and push the performance envelopes of the hardware.
  - Prognostics for Failure Avoidance through investments in establishing key performance characteristics, developing algorithms, testing to collect data points, and building sensors.
  - Probabilistic Design Analysis to model the probabilistic variability of design characteristics
  - Benchmarking to evaluate existing Army and industry data on like systems components and functions.
  - Consulting from industry experts in PoF, RET and PDA, including outsourcing of selected analyses.

**Most Funding available for execution  
 prior to MGV CDR (for design influence)**

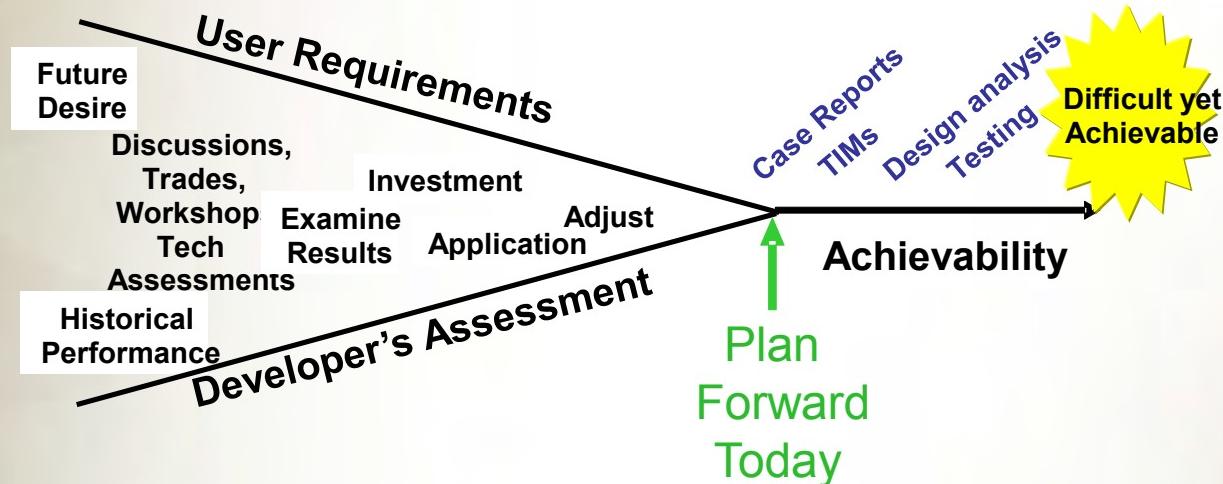
**Early work will focus on Common subsystems and NLOS-C for Increment 0  
 \$50M Award Fee available for exceeding requirements**

# FCS MGV Maintainability Design Influence

- Concurrent Engineering through Integrated Design Teams
  - Process has been documented as a System Engineering process
  - Multi disciplined walk-through of focus areas with designers
  - Based on Carlson's Pit-Stop Principles
  - Begins with sub-allocation of requirements
  - Identification of worst case access problems
  - Maintenance task analysis (using motion analysis)
  - Challenge the designers with time allocations (for MTTR)
    - 10 minutes to access
    - 15 minutes to remove/replace
  - Assess Crew repair capability with questionnaire to address MaxTTR and 80% Crew Chief requirement
    - Is a lift required?
    - Is task described in IETM?
    - Can it be done with the 10 on-board tools?
    - How often will it fail?
    - Etc.
  - Reevaluate metrics (TTR) after redesign



# Summary



- FCS Requirements have converged based on need and capability
- FCS MGV RAM requirements are challenging but achievable given our present cost and schedule
- Primary emphasis in early design influence for little “m”, big “R”.
- FCS did it right!...and committed the resources to design influence
  - *Implementing the RAM-T Case Approach*
  - *Component Maturation focuses on high risk technologies*
  - *Focus is on failure mode mitigation through PoF and RET*
- This investment will yield a highly force effective and lower logistic footprint fleet through high Ao, low MR and plug and play maintainability

**Early Program Resource Commitment => \$21B in LCC Savings**